THE ENGINEERING CONSTRUCTION WEEKLY

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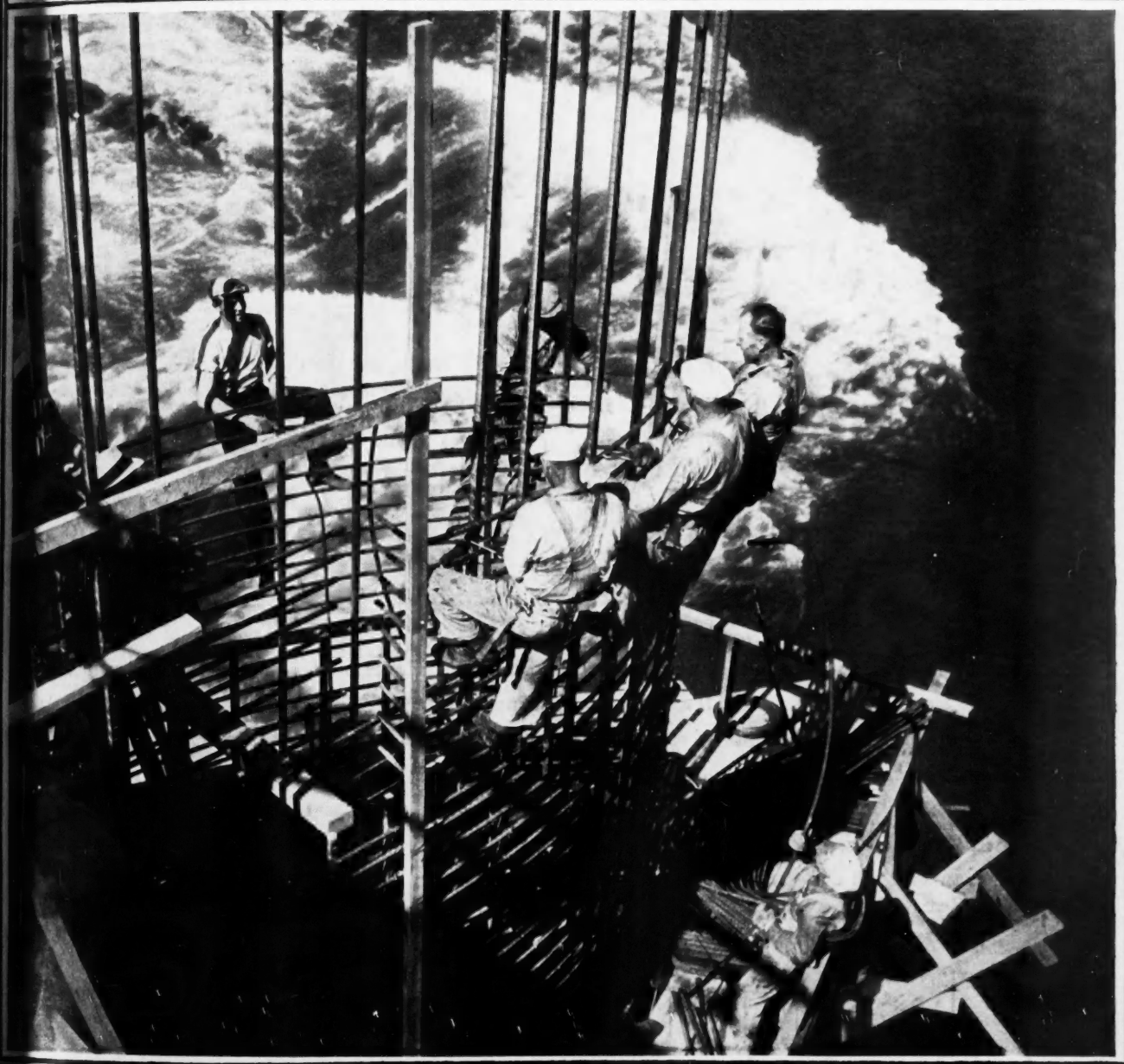
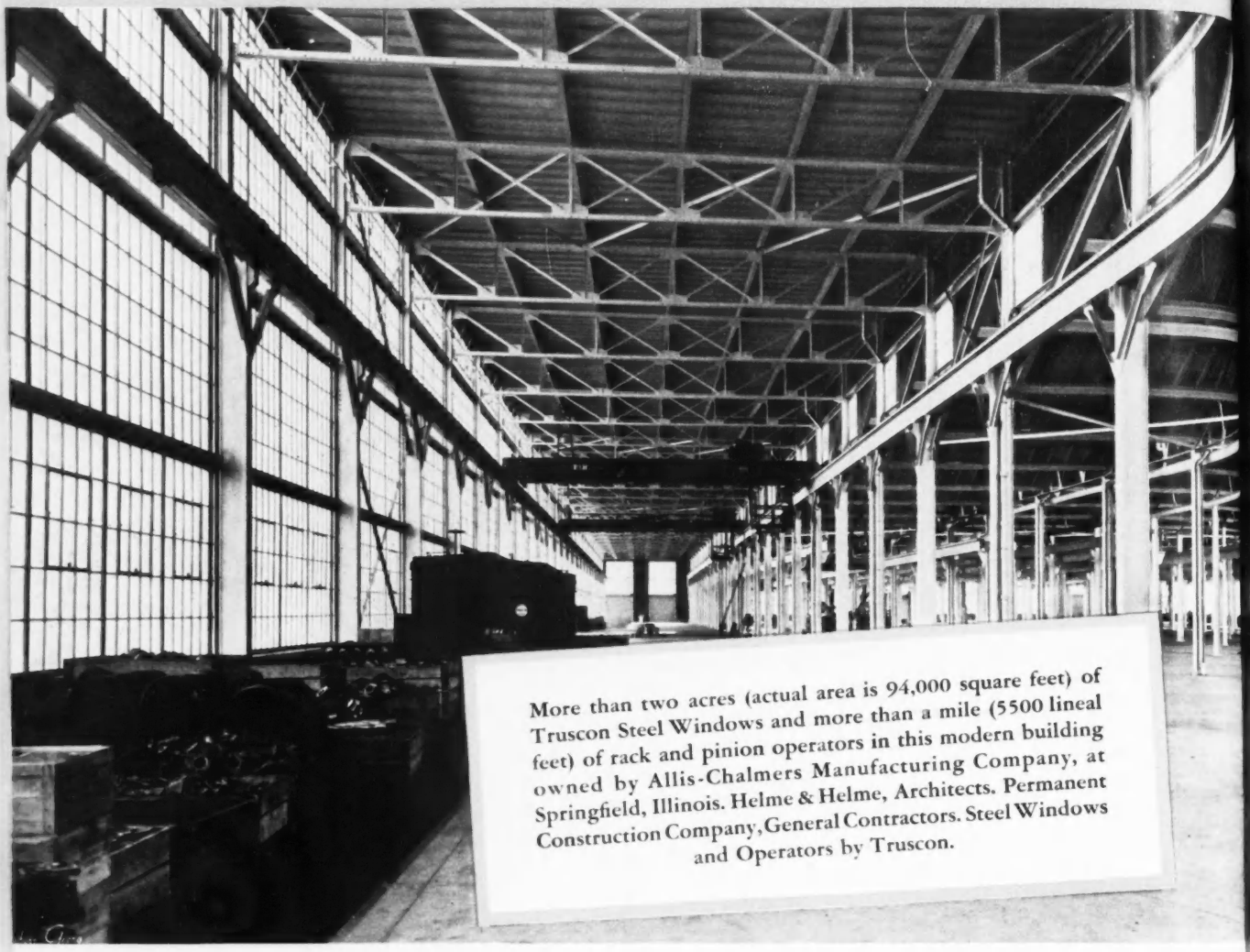
July 22, 1937



BRIDGES · IRRIGATION · FLOOD CONTROL · FOUNDATIONS · DAMS · HIGHWAYS · WATERWORKS · STREETS · SEWERS ·

2 ACRES *and* A MILE

in terms of Truscon Steel Windows



More than two acres (actual area is 94,000 square feet) of Truscon Steel Windows and more than a mile (5500 lineal feet) of rack and pinion operators in this modern building owned by Allis-Chalmers Manufacturing Company, at Springfield, Illinois. Helme & Helme, Architects. Permanent Construction Company, General Contractors. Steel Windows and Operators by Truscon.

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YOUNGSTOWN · · · OHIO

What Price "Planned Economy"

FOR some time past the "advanced thinkers" have been sowing the notion that a free industry of individual enterprise no longer can meet the requirements of the American people. What we need, they tell us, is a "planned economy", under which a central bureau, combining in itself all the knowledge, wisdom, vision, honesty and disinterested concern for the public welfare, would tell us just what our people are going to need and how much of it, just how we should organize and build to produce it and just how far anyone should be permitted to discount future progress. Otherwise, they warn us, there can be no hope. Qualify that statement as much as you please; it remains the essence of "the planned economy."

To be fair about it, let us admit that all this is a splendid objective. Let us admit also that the checks and balances of the existing system frequently let us down and that individual enterprise in industrial production does involve waste and loss. Let us admit that self-interest frequently dictates courses not altogether in the public interest. Let us even admit that our existing machine needs considerable overhauling in behalf of more consistent performance.

BUT WHEN WE HAVE admitted all that, it still is fair to ask for some assurance that the new scheme would work any more happily. We know what is wrong with what we have; why should we assume that all would be well with what we would get? Those who advocate revolution rather than evolution, who would scrap what is for their own conception of what should be, habitually ignore the defects of their programs; or they gloss them over in order to keep our minds focussed on the magnificent objectives.

But no practical man ignores them; he knows that they are there. He wants some assurance that the plan will *work*. Where shall we find the supermen? How select them? How shall we seal them up to insure that their virtues and genius continue to function with the requisite detachment? What check can we apply to them to replace that of survival in competitive effort? Have we any right to expect from them any better results than now flow from the interplay of millions of individual minds, each dealing with a small part of the problem and each free to stake its survival on its ability to do the right thing at the right time?

In Russia this whole idea is getting a workout on a national scale. Perhaps it is too soon to draw definite conclusions as to ultimate success or failure, but surely it is reasonable for us to profit by our observation of that experience.

In a recent dispatch to the *New York Times*, Harold Denny touched on one of the chief difficulties of such a program: its tendency to bog down in the muck of bureaucracy and to fail as miserably from stagnation as our system may go haywire from excessive enterprise. But let Mr. Denny quote from the Russian journal, *Pravda:*

BECAUSE OF THE UNREST generated by the recent disciplinary activities of the government, says *Pravda*, "a state of confusion has overcome many executives and engineers. Some of them, in their desire to insure themselves, stopped making any decisions to try to obtain the sanction of a higher executive or organization for any measure which it was their duty to carry out. That is the reason for the enormous mass of correspondence which is flooding the Commissariat of Heavy Industry. Executives write the Commissariat about every trifle. Executives and engineers of factories become infected with evasion of responsibility."

As a result of this, *Pravda* reports very unsatisfactory results, sees reason for alarm and demands immediate measures to remedy the defects.

Many other reasons justify the misgivings of the practical man, whether he be employer or employee, as to the merits of federal economic planning. But this one menace of bureaucratic domination alone should restrain us from assuming that theoretical gains can be achieved without practical losses. And these losses are none the less real because we may have had, as yet, but limited experience with them.

Willard Chevalier

· ENGINEERING NEWS-RECORD ·

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*for an Economical and Dependable source of Acetylene . . . use a CARBIC**

CLP-4 ACETYLENE GENERATOR

SPECIFICATIONS

CLP-4 Low-Pressure Acetylene Generator

Height Overall	51 in.
Diameter	14 in.
Weight—Empty	80 lb.
Weight—Fully Charged	215 lb.
Shipping Weight	100 lb.
Carbic No. 20 Cakes—Full Charge	8 cakes
Acetylene Yield—Per Charge	80 cu. ft.
Generating Capacity—Per Hour	45 cu. ft.

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A Linde representative will gladly show you the many additional features of the CLP-4 Acetylene Generator, including its sturdy, welded construction and the ease and speed with which it can be emptied and recharged. A descriptive folder is available from the nearest Linde office. The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, New York and principal cities.

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THIS WEEK AND NEXT

SIXTEEN YEARS AGO Baltimore began planning to build a viaduct as an aid to traffic. Fourteen years later the contractor went to work. The vicissitudes which beset the project in that 14 years were many and varied. Not engineering in the technical sense, they are nevertheless of interest to engineers because every project has to surmount them.

Disposal of garbage by feeding it to hogs has been a financial success at Flint, Mich. How infinite care in handling refuse and in managing the hog farm has brought this result is set forth on p. 137.

Pertinent comment on flood control plans for New England made recently by Prof. H. K. Barrows is reported on p. 144. Prof. Barrows' long study of the subject makes his views especially valuable.

Interest in the German "autobahn" continues active. In this issue, Paul Wooton, an experienced newspaper man, gives his impressions of these superhighways together with some pertinent notes on the use of construction equipment.

A large construction shaft for the East River tunnel at New York put unusual problems up to the contractor. The lining and framing are notable, as also are the construction operations.

Turning the Missouri River from its course at Fort Peck Dam had to be speeded up to meet an emergency. How long-laid plans were changed quickly but with success is told graphically by Capt. C. H. Chorpening on p. 153.

PENNSYLVANIA'S plans to capitalize on work done for a forgotten railroad project are to be told in next week's issue. The story of how tunnels dug and fills built in one of the historic railway battles of a half century ago are to be used for construction of a superhighway is replete with interest.

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THE COVER PICTURE is of workmen on one of the piers in the swift waters of the Columbia River at Bonneville Dam. Construction men at times need to be as surefooted as a sailor working in the rigging.

Traffic marker of Atlas White portland cement, on Wayside Drive, Houston, Texas. Contractor—Gulf Bitulithic Company of Houston.

Once in—they're in for good!

● No "extras" will ever be required with this traffic marker. Once in, there's no extra work — no extra expense. Its first cost is the last cost.

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ATLAS WHITE PORTLAND CEMENT
FOR TRAFFIC MARKERS

THE WEEK'S EVENTS

Discuss Seven TVA's In Committee

House group begins hearings on proposal for additional regional plans

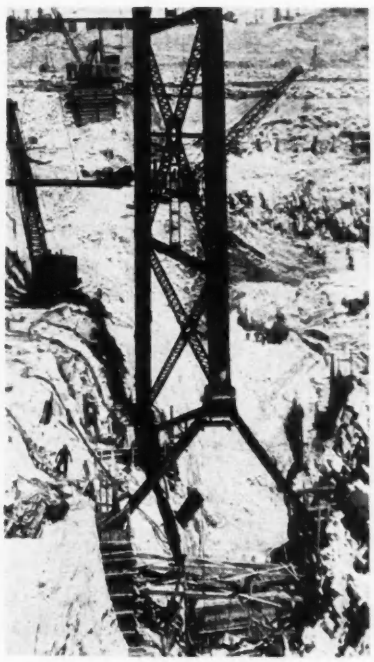
Hearings on the proposal to set up seven regional authorities to plan the development of the country's water resources, following the pattern established with the Tennessee Valley Authority, started July 15 before the House Committee on Rivers and Harbors. An announcement by Chairman Joseph J. Mansfield of Texas that the committee plans an intensive investigation into the proposal, with testimony from all federal departments concerned, as well as from private industry, indicated that the hearings will continue for some time.

The first witness to appear was Rep. John E. Rankin of Mississippi, head of the House power bloc, who introduced the companion bill corresponding to the Norris bill in the Senate. The committee also has before it a somewhat similar, but less far-reaching bill introduced by Chairman Mansfield.

Mr. Rankin opened his testimony by announcing three amendments to his own bill, all of which can be attributed to recent difficulties within the TVA. The effect of the amendments would be to substitute for each of the three-member authorities appointed for nine-year terms a single directing officer to serve for seven years, but leaving the present set-up in TVA unchanged, and to make the regulation of re-sale rates on power sold by the authorities to public utilities mandatory rather than permissive. Mr. Rankin next upheld the seven-authorities proposal as a necessary step in the conservation of natural resources and the control of floods. His discussion soon shifted, however, to the subject of hydroelectric power. "There is enough hydroelectric power in the navigable streams of this country and their tributaries to fully electrify every home and every commercial establishment in America, and possibly have enough left to supply the industrial requirements of the nation."

The witness pointed out that there

(*Continued on page* 127)



A COLUMN DOES THE SPLITS

An ingenious A-frame base was devised to carry a column of the high concreting trestle at Grand Coulee Dam over a deep fissure in the foundation rock. Pedestals for the A-frame were built into the sides of the fissure. Exceptionally strong framing was required, for the trestle is heavily loaded with three railroad tracks and a crane runway. Similar treatment was necessary for the adjacent bent, the last two in the 3,000-ft. bridge across the Columbia River.

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River and Harbor Bill Passed

Approval delayed by congressional dispute on amount to be appropriated for flood control

Belated action by the Senate on July 15 sent to the White House the bill appropriating $194,536,063 for non-military activities of the War Department during the fiscal year just beginning, which provides for the river and harbor and flood control projects of the Corps of Engineers.

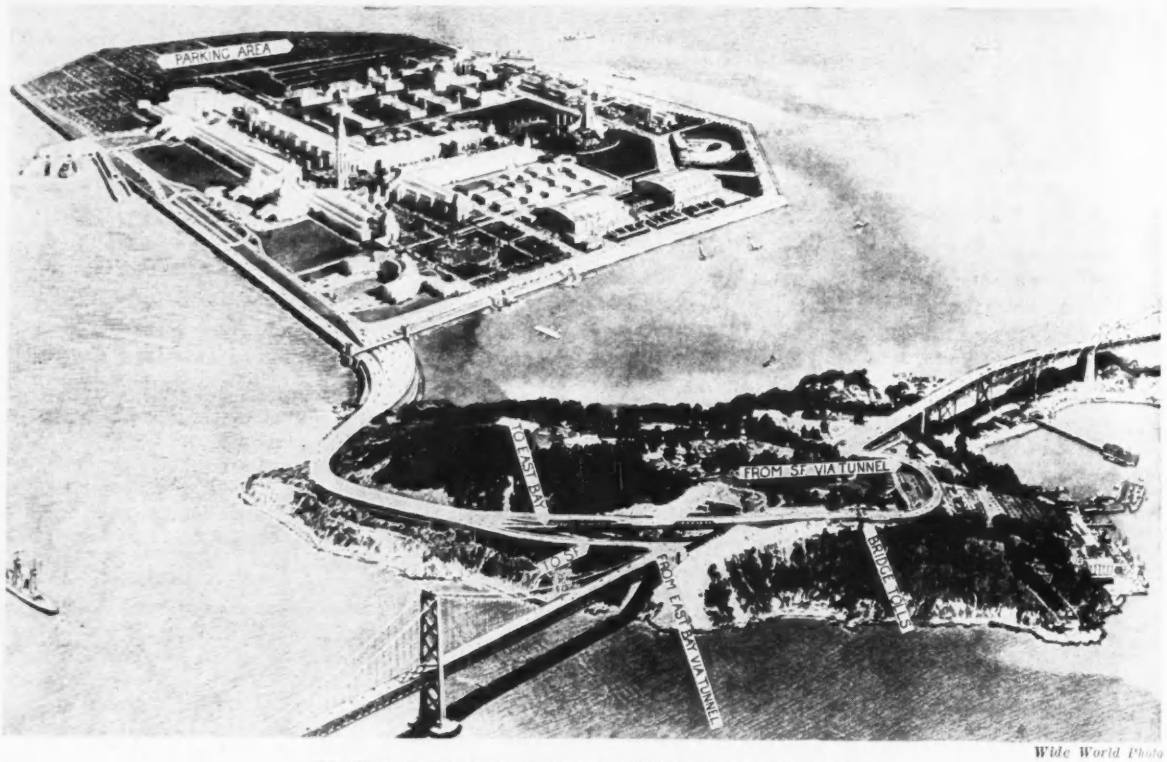
The delay in approving the bill, which has seriously hampered the program of the Army Engineers, was caused by a dispute between the House and Senate as to the amount to be appropriated for flood control work. As passed by the House, the bill appropriated $30,000,000 for projects authorized in the Omnibus Flood Control Act of 1936 and an additional $22,500,000 for work on the lower Mississippi River. These amounts were doubled by the Senate. In the compromise finally approved the direct appropriations were limited to the lower amounts, but an equivalent sum was earmarked from the relief appropriation to be expended under the direction of the Chief of Engineers, who was directed to utilize relief labor insofar as practicable. The net result was to limit the direct appropriation to the amount included in the budget, while permitting double this sum to be expended on flood control work.

The appropriation for river and harbor improvements was not in dispute, and was passed by both houses. For new projects and the continuation of work now under way the sum of $90,822,101 was provided; with additional $37,177,899 for the maintenance of existing facilities.

• • •

Fourth Anti-Parkway Suit Defeated in St. Louis

A fourth attempt by St. Louis riverfront property owners to enjoin federal and St. Louis city officials from proceeding with the $30,000,000 Thomas Jefferson Memorial Park project has been denied by United States District



Wide World Photo

TRAFFIC FACILITIES FOR SAN FRANCISCO WORLDS FAIR

VEHICLE access to and from the Golden Gate International Exposition in 1939 will be via the Bay Bridge and Yerba Buena Island over superhighway connections to cost $600,000. This drawing, superimposed on an air view, shows the traffic arrangements, part of which will be permanent, the remainder temporary for fair use only. Contract has been let for the first 1,700-ft. length of roadway from the causeway fill southward toward the bridge. Other facilities include 900 ft. of fill between the island and fair site, and five highway branches on the island aggregating 7,600 ft. long. The main roadway, 64 ft. wide, will accommodate six lanes of traffic; 30 ft. of this width is temporary steel and timber trestle construction to avoid unsightly excavation. As boats will transport the bulk of visitors to the fair, the highway connections are designed to handle only 3,000 cars per hour.

Judge Charles B. Davis. The 43 property owners are expected to file a motion of appeal with the United States Circuit Court of Appeals for a review of Judge Davis' adverse ruling. Judge Davis stated that the jurisdiction of the court in the proceedings, and hence its right to issue the injunction, was in serious doubt.

Shortly after the injunction was denied, three new condemnation suits for the purpose of obtaining additional ground to be included in the memorial project were filed. Property in 13 blocks of the 37-block area is affected.

• • •

Keystone Now Kingsley Dam

Directors of the Central Nebraska power and irrigation district have announced that they will honor the memory of the late George P. Kingsley, pioneer Minden, Nebr., lumberman and banker, by naming the district's dam at Keystone the Kingsley dam.

San Jacinto Tunnel Crews Break Records

Tunnel crews of the Metropolitan Water District of Southern California broke all previous records on the 13-mile San Jacinto tunnel during the thirty days of June, according to a report issued July 10. The new excavation record showed an advance of 806 feet made in the Cabazon shaft sector of the tunnel. The report, issued by F. E. Weymouth, general manager and chief engineer of the district, showed that the June record of the San Jacinto tunnel workers had exceeded the best previous record from any one shaft by 39 feet. This old record was established at Cabazon shaft in June, 1934.

Greater monthly progress than that of the Cabazon shaft crews had been chalked up on a few other Metropolitan Water District tunnels, it was pointed out, but none of these presented construction difficulties comparable to the San Jacinto bore. Approximately nine miles of the 13-mile tunnel have been excavated. Work is being pushed forward from both the Cabazon and Potrero shafts. At the same time, a third working entrance to the tunnel is being opened midway between these two shafts for the purpose of increasing the number of faces from which progress can be made.

• • •

Aluminum Ore Co. Builds Plant

Aluminum Ore Co., subsidiary of Aluminum Co. of America, plans construction of a $4,000,000 bauxite ore reduction plant on a Mobile, Ala., site leased from the Alabama Docks Commission for a 99 year period. The company operates a plant in East St. Louis, the only one of its kind in the United States. The plant's reduction ovens will require 100,000,000 hp. of electricity and will employ between 400 and 500 persons.

THE CURRENT TREND

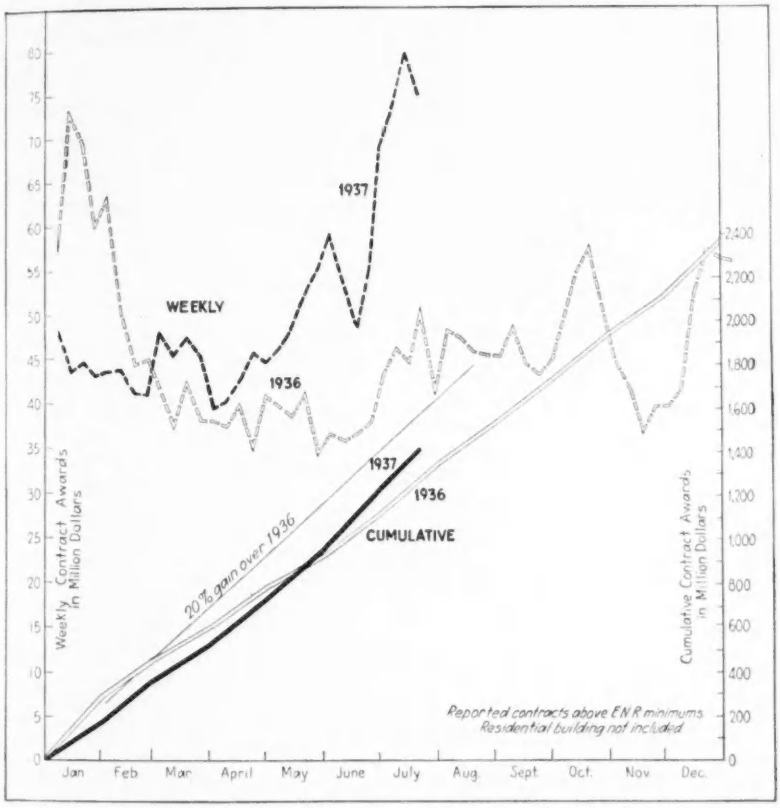
This week's news of contract volume and construction cost factors

Construction Gain Nears Bogey

Half year's contracts total 15 per cent ahead of 1936 figure and the trend continues upward

Full data for the first six months show construction ahead of 1936 and continuing to gain. The contract curve is nearing the bogey line of 20 per cent increase forecast early in the year.

back of this condition, continuing gain is to be expected, with every prospect that the line of total construction will reach 20 per cent gain by fall. Since the advance is steady rather than spec-



Working against the disadvantage of a delayed season, by the end of March engineering construction had overcome this handicap. By April it passed the abnormal first-quarter figures of 1936, result of the PWA's windup rush. At midyear the curve showed better than 15 per cent gain over a year ago.

Meantime housing has jumped 30 per cent ahead of 1936; the large housing shortage and new-family demand, combined with availability of building funds, is having its effect.

At present public works are holding steady while private construction is rising consistently. Considering the factors

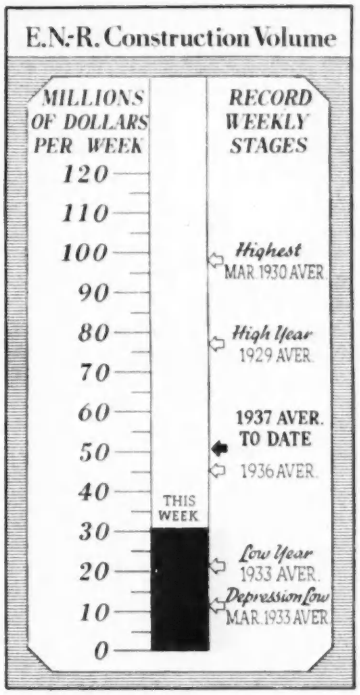
tacular, high cost of building and strikes are less powerful than the recovery forces.

• • •

Construction Briefs

GAINS IN BUILDING during the first half of 1937 are highest in New England and lowest in the South Central states, Dun & Bradstreet report. New England gained 73 per cent, the East Central states 41 per cent.

INDUSTRY HOLDS ITS ADVANTAGE despite hot weather. Automobile production last week was 17 per cent over 1936, steel 20, electric power output



THIS WEEK'S FIGURES

CONTRACTS

(Thousands of Dollars)

	Week Ending July 23 1936	July 15 1937	July 22 1937
Federal	$16,895	$3,826	$2,167
State&Municipal	16,928	32,171	12,859
Total public..	$33,823	$35,997	$12,026
Total private	17,169	23,440	15,699
TOTALS ..	$50,992	$59,437	$30,695

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

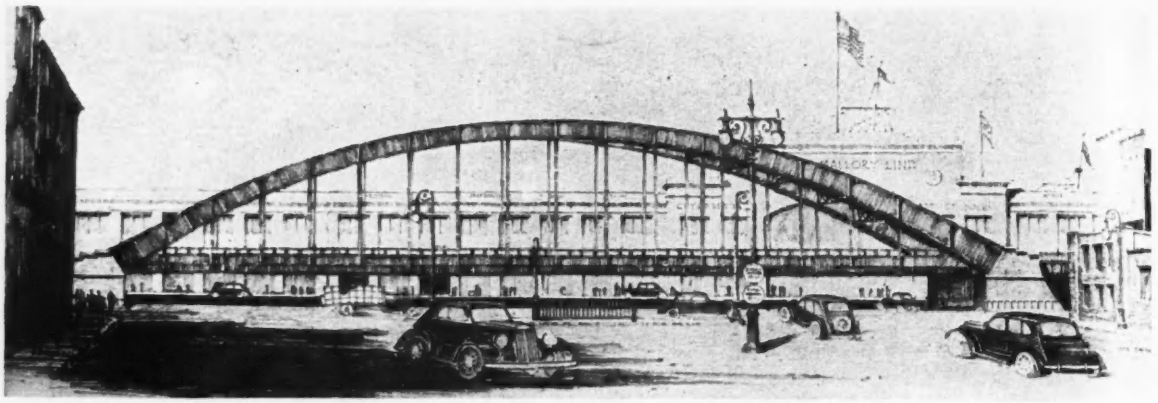
(Thousands of Dollars)

	Week July 22	Cumulative
NON-FEDERAL WORK.	$30,465	$881,002
State & mun. bonds....	16,995†	308,591†
Corporate securities....	17,350	302,437
PWA loans and grants.	113,880†	40,035†
Fed. Aid for Highways		200,000
FEDERAL WORK.....	57	57
TOTAL ALL WORK....	$30,522	
1937 (29 weeks).....		$881,059
1936 (30 weeks).....		$1,186,035

† Includes transfer from federal to private investment financing through sale by RFC of PWA bonds.

7. But a new industry is making high records: air-conditioning did as much business in the first five months of 1937 as in all of 1936.

COMMON LABOR GAINS in wage earnings over skilled labor since the code days of 1933 are being reduced by current gains of skilled labor through union demands. Progress in the organization of common labor may neutralize this advantage.



PROPOSED 360-FT. BRIDGE TO SPAN CANAL ST. ON THE SOUTHWARD EXTENSION OF NEW YORK'S EXPRESS HIGHWAY

THE NEW southward extension of the West Side express highway from Canal St. to Duane St. in New York City will have a 360-ft. bridge at Canal St., the only one in its entire length to 72nd St. Vehicular traffic at this point is said to be the heaviest in the world. Passenger cars using the express highway, the congestion of trucks on Canal St. all the way to Manhattan Bridge, and the flow of cars and trucks through the Holland tunnel bring 50,000 vehicles daily to the junction of Canal and West Streets. Work on the foundations has begun.

Propose to Bridge Lake Washington

Washington highway department will conduct surveys for shortcut east of Seattle

The Washington state highway department will start work on a survey for a proposed bridge across Lake Washington at Seattle, following appropriation of $12,500 by King county commissioners to pay survey expenses. The commission has pledged itself to appropriate another $12,500 if the survey requires it.

The bridge will cost from $2,000,000 to $3,400,000, depending upon the type of bridge approved. The most discussed location for the bridge is between Seward Park in Seattle and Mercer Island, near the eastern shore of the lake. This would require a bridge 3100 ft. long over water. An existing bridge between Mercer Island and the eastern shore would be linked into a new highway saving 13 miles between Seattle and eastern Washington.

The Puget Sound Bridge and Dredging Co. of Seattle has a franchise from the war department for a bridge at this site but is declared willing to surrender its franchise if reimbursed for its surveys. Data gathered by the company will be utilized in the new survey, although new borings and other examinations also will be made.

Joseph Jacobs, Seattle consulting engineer, has suggested construction of a two-lane structure costing an estimated $2,000,000 to be duplicated when traffic volume may require additional bridge capacity.

Henry Hudson Bridge Second Deck Planned

An upper level for the Henry Hudson Bridge and improved roadway facilities through Inwood Hill Park and Spuyten Duyvil north from Manhattan on the west side of Greater New York is planned by the Henry Hudson Parkway Authority. The present level of the bridge and the present pavement through Inwood Hill Park will be used for southbound traffic only and a new parkway roadway will lead onto the proposed upper level of the Henry Hudson Bridge to bring the northbound traffic from Manhattan into the Bronx. In place of the present eight toll gates there will be eight in each direction. Bids on the first contract were received July 20.

• • •

Pickwick Dam Diversion Accomplished

The diversion of the Tennessee River through the Pickwick Landing dam power house has been accomplished. All the mass concrete had been poured prior to diverting the stream, and totals 198,000 cu. yd. There remains a total of 8,000 cu. yd. to be poured throughout the power house superstructure. Six of the 24 cells which will comprise the middle section cofferdam have been driven and work is progressing in extracting sheet piling from the cut-off of the power house cofferdam to be used in the middle section. When completed, this section of the cofferdam will inclose an area of 4½ acres in the bed of the Tennessee.

Bridge Conversion at Sioux City

Old railway bridge reconstruction for highway use should be complete by fall

Conversion of the old Missouri River-Sioux City Bridge at Sioux City, Iowa, from railway to highway use, involving installation of a grid decking floor on a length of 1,950 ft. and replacement of the machinery and electrical equipment, is progressing well and is expected to be completed by fall. Work is going on under direction of Waddell & Hardesty by Haakinson & Beaty of Sioux City, who are reconstructing the deck provided by Irving Iron Works Co. of Long Island City, N. Y.; the Earl Gear & Machinery Co. of Philadelphia is replacing the old cast-iron machinery of the swing spans; and P. H. Zipp of New Brunswick, N. J., is doing the electrical work.

The bridge was built about 1893 for a single-track railway, to designs of J. A. L. Waddell, but after some years railway operation was abandoned and a single-track trolley line was operated over the bridge. It comprises two 500-ft. simple truss spans and two 475-ft. swing spans. Trusses are 25 ft. on centers, carrying the railway track on open-tie floor and a walkway inside the trusses on either side. Two 9-ft. roadway cantilevers are outside, decked with wood block on plank.

In the reconstruction the space between the trusses is being converted to a 20-ft. roadway with grid decking. One of the outside cantilevers will be used for a sidewalk and the other for

an emergency roadway. As the bridge was originally designed for E-30 railway loading the trusses are strong enough to carry full highway loading. It was important, however, to avoid increasing the load on the old drum and turntable, and the reconstruction as carried out involves no increase of weight — the cantilever load being slightly reduced and the roadway floor weight being slightly increased.

• • •

Seattle Sets New Date For Ruby Dam Bids

Bids for construction of the $4,500,000 Ruby power dam, originally called for July 1, have now been scheduled for July 22 by the Seattle board of public works. Bids will be opened then on slightly revised specifications.

The two-year extension of PWA, extending the time allowed for the construction by the same period, was given as the reason for the postponement. Prospective bidders had questioned the possibility of completing the project within the time required, and as a result few proposals were being prepared. The board believes that the two-year extension will result in more competitive bidding. Revised specifications provide for an inspection gallery at the dam.

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St. Louis Steel Workers Return to Work

About 400 workers in 18 structural steel plans in St. Louis and East St. Louis have returned to work, ending a strike for higher wages, shorter hours and union recognition. The men were granted a 9-cent an hour increase in wages and a 40-hour week. The Structural Iron Workers Union, an A. F. of L. affiliate, is recognized as sole collective bargaining agent. The agreement runs for one year.

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Lake Charles Seaway Reported Favorably

Favorable findings by the district engineer, by the Board of Engineers for Rivers and Harbors and by the Chief of Engineers are thought to insure a first class seaway and harbor at Lake Charles, in western Louisiana. Ocean commerce has increased rapidly at Lake Charles. Construction of a channel 30 ft. deep and 250 ft. wide directly from Lake Charles through the Calcasieu river to the Gulf is proposed. The present channel is 125 ft. wide.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

Southern members of the Labor Committee of the House of Representatives continue to demand that the Labor standards bill itself fix geographical differentials. Northern members insist that this be left to the board. Some members of the Committee from Northern states are insisting that the board's authority should include labor paid up to sixty cents an hour.

Secretary Morganthau on July 16 instructed the Treasury's Procurement Division to refer to the Department of Justice all cases in which bids on government purchases are received quoting identical prices unless there is "satisfactory affirmative evidence that no collusion was present" in the preparation of the bids. The order also applies to other cases where, in the absence of identical bids, it appears that collusion may have taken place.

Delay in securing approval of the Bonneville bill is becoming a matter of concern with those interested in the project. The power plant will be ready to operate in less than six months. No start toward negotiating contracts can be made until the bill passes. No agency can be authorized to operate the project and sell the power until after the passage of the bill. In the meantime the controversy over the agency waxes warmer. Some are of the opinion that control of power projects should be concentrated in the Federal Power Commission. Others insist that control should be in the Interior Department, since the Secretary of that department has the responsibility for the repayment of the investment in the dam. He also names the administrator for the project. The reclamation project and the handling of the power should be coordinated, the latter group thinks.

Members of Congress from Western states realize that they are face to face with the need for revising reclamation policy in so far as it contemplates complete repayment in forty years. Any substantial acreage reclaimed in the future, it is believed, will have to have a certain amoun of subsidy either directly or through power. Experience in the dust bowl has greatly increased the demand for irrigated land. Additional irrigated land also is essential to the welfare of the livestock industry.

Work is about to begin on the Buffalo Rapids project on the Yellowstone river which is typical of other projects now under consideration. Half of the construction cost will be met out of relief funds. Water users will not be asked to repay that part of the cost. The remaining $800,000 of the cost will be repaid over the 40-year period.

Receiving appropriations under a continuing resolution is highly unsatisfactory to the Bureau of Reclamation. Delay in securing the approval of the Interior Department appropriation bill means that one-twenty-fourth of the amount appropriated for the last fiscal year is made available every fifteen days. Since much of the work of this bureau is seasonal much more of the appropriation than the average is expended during the summer months.

Settlement of the controversy over interest charges at Boulder dam may have to go over until the next Congress. Section six of the Bonneville bill provides for a public hearing to consider what rate of interest must be charged to prevent discrimination. The Secretary of the Interior is directed to put into effect the rate determined by the reviewing agency. The Bonneville bill failed at the last session because of the controversy over interest charges. Those interested in the Bonneville project are trying to remove that danger at this session. If they are successful it would mean that the contractors would have to continue to pay the higher interest rate. The contractors are: the City of Los Angeles, the Metropolitan water district, Glendale, Pasadena, Burbank, the State of Nevada, the California Edison Company and the Nevada-California Electric Corporation.

The question of the deferment of the allocation of $25,000,000 of the cost to flood control also is involved. Some think any postponement of the flood control allocation would pave the way for the charging off of that item.

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Harry C. Plummer Heads Clay Products Group

Harry C. Plummer has been appointed chief engineer for the Structural Clay Products Institute, Washington, D. C. He will direct all engineering activities of the Institute and supervise a series of special engineering services for S.C.P.I. members. Mr. Plummer has been on the faculty at Case School of Applied Science, president of the Sterling Enginering Co., Cleveland, and from 1934 to the time of his present appointment he has been chief engineer of the Brick Manufacturers' Association.

Ohio Flood Control Passes House

Bill to provide levees and flood walls in lower Ohio now goes to Senate

The House of Representatives on July 19 passed a bill by Representative Whittington, chairman of the committee on flood control, authorizing the expenditure of $24,877,000 for levees and flood walls on priority and emergency projects in the lower Ohio valley. The bill now goes to the Senate for action.

The effect of the bill would be to add to the present list of authorized flood control projects such additional measures as may be selected by the Chief of Engineers from his report recommending a comprehensive flood-control program for the Ohio River which was submitted to Congress last April. The bill will make possible the expenditure of part of the $105,000,000 appropriated in the recently-passed War Department appropriation bill covering non-military activities for sorely-needed projects along the Ohio.

Included in the Whittington bill is a section authorizing the expenditure of $300,000 for channel-clearing operations (not restricted to the Ohio) and authorizing the Secretary of Agriculture to make upland studies relating to soil erosion control and water control.

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Mexico Plans Additional Rail Construction

The federal government of Mexico is planning railroad construction in addition to the 'Big Four" railways it is building as a result of federalization of the national railways of Mexico. The Big Four includes one in the southeast, two in the southwest, and one in the northwest. The first additional rail construction will be the building of a short line between San Luis Potosi City and Tampico, in order to speed up traffic.

In addition to government work, private rail construction is being pushed. A steam or electric railroad to move Tabasco State bananas faster to home and foreign markets is to be built along the left bank of the Teapa river by a company, Compania Transportadora de Platano Roatan de Teapa, S. A., organized by banana industrialists, who are purchasing stock in the company to afford funds for building the railroad.

A cooperative society of mechanics is building a railroad between Altotonga, a Vera Cruz state mining and agricultural center, to Barra de Nautla, a gulf Communications and Public Works of port. Engineers from the Ministry of the Mexican government are supervising the job.

In the "Big Four" government railroad, construction continues to go forward. The southeastern railroad, connecting Mexico City with Campeche and Yucatan states, has 167 of the 780 kilometers graded and ready for early rail laying. This line is expected to be completed for service during 1940.

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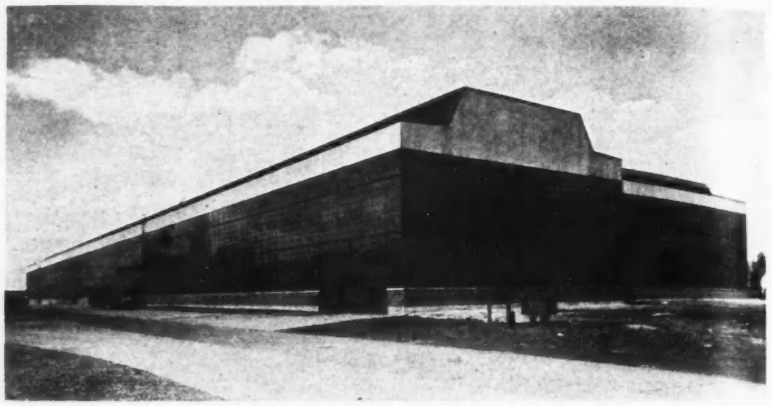
New Power Contract For Boulder Dam

Boulder Dam will contribute an unexpected three-quarters of a million dollars to the United States Treasury during the next three years as a result of an interim power contract approved July 18. The Bureau of Reclamation has been authorized to negotiate a contract with the Nevada-California Electric Corp., under which the company would begin purchasing Boulder Dam power immediately. The company, one of the original Boulder Dam power purchasers, was not required to take and pay for power under the contracts negotiated in 1930 until 1940.

June collections for Boulder Dam power were $150,000. With that payment a total of $1,200,000 has been turned in to the Treasury, including $900,000 advance payment on equipment by Pasadena and Glendale. The contract for firm power with Los Angeles did not begin until June 1 but $150,000 had been collected for secondary power before that date. On July 10 Lake Mead was half full, containing 15,250,000 acre-ft. of water. Two years will be required to fill the lake.



GLASS USED EXTENSIVELY IN NEW INDUSTRIAL BUILDING

Glass was used to an unusual extent in the new Chrysler DeSoto Press Shop at Detroit. About 90,000 sq. ft., or 52 per cent of the wall and roof area is either double strength window glass or hammered wire glass. Simplicity was the keynote in the design of the building. Recently its designer, Albert Kahn, Detroit, won first prize in a contest sponsored by Architectural Forum and the Pittsburgh Glass Institute for the best use of glass in building design.

St. Louis Span Approaches Ready Next Fall

Approaches to the St. Louis municipal bridge are expected to be complete and ready for handling train service next fall. On the east side of the bridge the three railroad approaches are completed except for laying of trackage and making necessary connections with railroad lines. On the west side of the bridge one approach has been completed and in use for years, while two other connections with the bridge are under way. All of the work should be completed by Oct. 1.

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Highway Officials Meet in Portland

Representatives of highway departments of eleven western states will meet in Portland, Ore., Aug. 16, to consider standardization of Pacific highway codes. The meeting was called by Ray Ingles, director of the California department of motor vehicles, to draft an interstate contract providing for reciprocity in treatment of commercial and private vehicles on highways.

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Permanent Building Exhibit

Portland, Ore., is to have a permanent building material and appliance exhibit. Sponsored by the Oregon building congress, it will be located in the Portland public market. The exhibit will include material incidental to construction, rehabilitation or refurnishing all types of buildings.

Discuss Seven TVA's In Committee

(Continued from page 121)

are two opposing schools of thought regarding this power. According to the first, it is private property to be developed by private capital for private gain; according to the second, that it is public property to be developed in accordance with the best interests of the public. He denied that it is the intention of the public power advocates to destroy private property, but stated emphatically that it is their intention to squeeze the "water" out of utility valuations. To illustrate this point, he cited the $398,000,000 investment of the Hydroelectric Commission of Ontario, which produces one-twelfth as much power as the entire U. S. system, for which the industry claims a valuation of $12,000,000,000. This indicates, according to Mr. Rankin, that the U. S. industry is over half water.

On the tax issue, Mr. Rankin stated that all taxes paid by privately owned utilities amount to only about 1 mill per kilowatt-hour. Accordingly, he contended, any loss in tax revenue through increase in public operation would be far overbalanced by lower consumer rates. He then repeated his charge that the American people are being overcharged between $1,000,000,000 and $1,500,000,000 per year for electricity, according to the "yardstick" used for comparison.

The Chamber of Commerce of the United States has expressed its opposition to the pending regional authority bills. George H. Davis, president of the Chamber, states that the bills would abandon principles of national policy which the Chamber membership has approved. Mr. Davis states, "The Tennessee Valley Authority was avowedly set up as an experiment. Three hundred million dollars is the cost to the public for the experiment thus far. The results have not yet been demonstrated. It would appear that the extension of the experiment to six more similar Authorities spread over the entire country is neither timely nor justified."

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Flood Tunnels to Be Built in Mexico City

Construction of a tunnel to further protect the Mexican Federal District, which includes the city of Mexico, from floods during the rainy season, is being arranged by the municipal government of Mexico City. The tunnel is to be 11 kilometers long and designed to handle 50 cubic meters of water per second (1750 c.f.s). The estimated cost of the work is between $2,240,000 and $2,800,000, and efforts are to be made to complete the job in 1939 or 1940. The Ministry of Communications and Public Works is to have charge of the undertaking.

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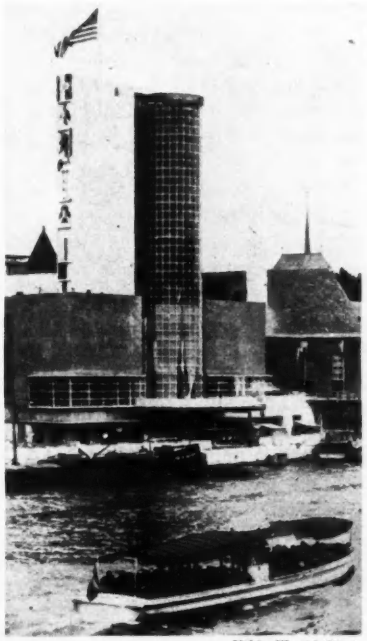
Time Extension Requested on Buffalo Sewer Job

The Buffalo Sewer Authority has deferred action on requests of two contractors for extension of time of completing their contracts. P. W. Graham Contracting Co., engaged in construction of a sewer in Van Rensselaer, Perry, Orlando and Elk Streets and Bailey Avenue, at a cost of $702,000, faces a penalty of $80 a day covered by a bond. The Graham Co. asked for extension on the ground that delay was experienced in the illness and death of P. W. Graham, president of the company. Henry W. Horst Co., Inc., is building a combined open cut and tunnel in Exchange St. and the old Erie canal bed at a cost of $1,555,000. The contract is reported 72 per cent complete. The Horst Co. faces a penalty of $100 a day, covered by a bond. It is contended that unexpected unfavorable weather and ground conditions retarded the Horst Co.'s work.



Wide World Photo

U. S. BUILDING AT THE PARIS FAIR

AMERICAN engineering and architectural design is shown by the American Pavilion at the Paris International Exposition. The building was opened July 4.

Utility Employees Form Union

Men in Pacific Gas and Electric Co. protect selves from professional organizers

Attracting widespread attention on the Pacific Coast is the California Gas & Electric Employees Union, incorporated under the laws of the state to represent employees of the Pacific Gas & Electric Co. in central and northern California. The new group, incorporated May 1, claims a membership of 6,000 out of the 11,000 total employees of the P.G.&E. The union was started by five young men who realized that, under the Wagner Act, the workers were sure to be organized whether they liked it or not, so they set out to protect themselves and fellow employees having no union experience from "professional labor organizers" from both AFL and CIO organizations.

With this in mind the group conferred with industrial relations experts, legal counsel and fellow employees and worked out a plan of organization with by-laws and principles designed to conform to the Wagner Act and to facilitate relations with management, all without the knowledge or help of the employers. They incorporated to show their sense of responsibility. Assessments are limited to $5 a year, and dues at present are 25c. per month. The union cannot affiliate with any labor organization without a 75-per-cent favorable vote, and cannot strike without a similar vote.

Fourteen locals have been established, one for each of the twelve divisions of the company, one for Kettlemen Hills natural gas production workers and one for the mobile construction forces. Most of the remaining 5,000 employees belong to either AFL or CIO units, and already the NLRB has a jurisdictional dispute on its hands involving all three groups.

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New York Subway System Opens New Line

Opening of regular operation on the New York independent city-owned subway system's newest link July 1 brought the boroughs of Brooklyn and Queens into closer communication. Mayor LaGuardia joined with borough officials and civic leaders in opening the route.

The completed line is 4½ miles long and cost about $35,000,000 to construct. It will bring to a total of 52 the mileage of new city subways available for passenger use.

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

More Labor Comment

Last week we published a series of letters from contractors commenting on the results of the field survey of construction labor relations and conditions, presented in Engineering News-Record June 24. Following are four more letters presenting additional views from widely-separated parts of the country. — EDITOR

Sir: The best way to handle the labor situation is a big question to the members of the Associated General Contractors. It is my personal opinion that it can best be handled by local groups of contractors because conditions vary greatly in different localities. There is no doubt in my mind that, due to the increase in wages which are being paid today and the increase in cost of materials, the construction program is being curtailed. I am hopeful that we have passed, or are about to pass, the peak of this labor unrest and will get back to a more sound condition.

Los Angeles, Calif. L. S. OAKES
July 3, 1937 Winston Bros. Co.

Sir: The labor situation in Texas differs considerably from that in the more highly industrialized sections of the North and East. With the exception of a few Gulf Coast cities, Texas has been mostly open-shop territory. The organized labor we have had has been affiliated with the AF of L, and many of us do not believe that the CIO can make much headway here. Our experience, typical of that of other contractors in this section, during the height of construction activities when wages were high and skilled labor was scarce we used union labor for all skilled crafts on some of our jobs, but signed no labor contracts. On other jobs we used all non-union workmen. In a few cases both organized and non-union labor was used, but this did not work out satisfactorily. However, under any of these arrangements there was no trouble of any consequence, and we feel there will be none where the employer acts fairly in dealing with his employees.

We do not contemplate a shortage of skilled labor in Texas, except, possibly, in the building trades and then only in case the building volume greatly increases above that in sight at present. Apparently WPA has not injured first-class workmen, but undoubtedly has hurt the mediocre class and the agitator-workers.

We agree with your statement that conditions are changing fast. As an example of changing attitudes a prominent building contractor recently expressed himself as strongly in favor of open shop, though he was formerly a closed shop operator. He said his change in sentiment was brought about by reading of the CIO disturbances in the steel and auto industries.

San Antonio, Tex. E. W. ROBINSON
July 7, 1937 McKenzie Construction Co.

Sir: Construction labor conditions in Iowa are not unlike those which prevail in many other states. Most building contractors other than small-town operators and the house builders, employ union labor exclusively, and have had little union trouble. Wage rates in Des Moines are rather high for a city of its type and size.

With few exceptions municipal and highway contractors have conducted their work open shop. These contractors have encountered no difficulty except in Des Moines, where five state highway bridges have recently been completed, but only after several delays extending for weeks as a result of riots and fights promulgated by the unions.

Last year four contractors working on a creek improvement project in Council Bluffs signed union contracts for the first time in their experience. The poorly-organized labor unions of the city, finding themselves short of the necessary members to man the work, took in inexperienced workers and farmers. Many of these new construction workers, 285 to be exact, have filed claims with the industrial commission for additional compensation on the supposition that they performed work of a higher grade than common labor. These claims are now to be arbitrated. A PWA investigation of this project has thrown the entire labor set-up in Council Bluffs into a turmoil.

The C. F. Lytle Co., of Sioux City, after securing a contract for a large overhead crossing in that city, signed up with the unions and is conducting the work without trouble. Yet G. G. Herrick, of Des Moines, has run into trouble on a similar project in Des Moines because of union difficulties. Carpenters are refusing to handle sectional forms made by non-union men last year and used on a previous job. The contractor is standing firm and there is no prediction as to the outcome of this strike.

Contractors throughout the state are almost equally divided on the labor question, making it impossible for the employers to present a united front. Labor leaders would like to organize all construction in Iowa, but without the backing of state or municipal officials, except in the city of Des Moines, they appear hesitant to launch an organized labor movement.

July 8, 1937 IOWA READER

Sir: While your survey published June 24 did not cover this section of the country it is a fairly accurate picture of conditions existing in California. Late last year and early in 1937 there was a serious shortage of skilled labor, but with the end of a $35,000,000 school building program, a drop in general building and temporary cessation of much of the Metropolitan Aqueduct work for the summer a fairly good supply of labor prevails at present.

Intense organizing activities in construction are taking place in the southern part of the state. Unions have made considerable progress with the assistance of longshoremen and truckmen operating through the lumber and building material dealers to bring pressure to bear upon the contractors. These organizing activities have developed bitter competition between AFL and CIO groups, which is disturbing the labor situation. Meantime the industry is marking time, doing only what it has to do, and the outcome is difficult to predict.

Generally speaking, the public works building operations in this territory are AFL union jobs, while private work is open shop. Highway

construction is open shop under prevailing wage rates determined by the state highway department, equivalent to union scales. Heavy engineering construction is on an open shop basis with a large percentage of the workmen being members of CIO, though a few large projects are manned by union groups affiliated with the AFL.

July 7, 1937 CALIFORNIA OBSERVER

Sullivan's Panama Service

In our report of the award of the Sir John Kennedy Medal of the Engineering Institute of Canada to John G. Sullivan (*ENR* June 24, p. 933), it was stated that Mr. Sullivan served as acting chief engineer of the Panama Canal for two years. This was found to be an error.

In reply to our request for an accurate statement of his connection with the canal work, Mr. Sullivan says:

"I was employed by the Isthmian Canal Commission the latter part of August, 1905, and my resignation took place in February, 1907. I was employed as assistant chief engineer. The only time I had entire charge of the work on the isthmus was for a couple of months when John F. Stevens was in the United States educating "the powers that be" to the fact that the lock canal was preferable to the sea level type.

"I am sorry that your notice appeared as it did; some people will think that I tried to take credit to myself that did not belong to me."

A Drop in the Bucket

Sir: The news item on p. 930 of the June 24 issue of *Engineering News-Record* entitled "Power Secondary, Norris says, bill setting up regional authorities is primarily for navigation and flood control", being a report of Senator Norris' statements before a subcommittee of the Senate on agriculture and forestry, has been read by me with much interest. In the third paragraph of this article Senator Norris is reported as follows:

"The Ohio valley flood of January, 1937, has demonstrated the value of comprehensive river development in controlling floods. Although far from complete, the TVA dams withheld 32,000 sec.-ft. from the swollen crest of the Ohio, a difference which, in the Senator's opinion, would have wiped out the city of Cairo if it had not been withheld."

With the many years' experience of your editors in studying flood control in the Mississippi and Ohio valleys, you understand how misleading is the reference to the claim that withholding 32,000 sec.-ft. flow by the TVA dams saved Cairo from inundation. This quantity of water at Cairo was only a "drop in the bucket" as compared to the total flow at Cairo during the 1937 flood. As you know the flow through the old prehistoric channel of the Ohio River was about 71,000 sec.-ft., and the flow through the Cairo-New Madrid Floodway was reported at from 500,000 to 600,000 sec.-ft., with a total flow in the Ohio past Cairo of 1,900,000 sec.-ft.

Cairo, Ill. C. M. ROOS
June 28, 1937 Constructing Engineer

Bypass Roads

Sir: I have read the very interesting article by Arthur W. Dean referring to bypass roads which appears in *Engineering News-Record*, June 24, 1937. He says that no one has bothered to calculate the damage in dollars and cents due to traffic delays.

As long ago as 1925 this matter was discussed in a paper presented by me at a meeting of the Highway Officials of the North Atlantic States at Atlantic City and, further, in a paper entitled "Highways as Elements of Transportation" published in Vol. 95 (1931) of the Transactions of the American Society of Civil Engineers. Both of these papers referred to the calculations made tending to justify the large expenditures made for the bypass highway in New Jersey which provided practically uninterrupted transit through the cities of Jersey City, Newark and Elizabeth, N. J., of the traffic to and from the Holland Tunnel.

Mr. Dean, however, has called attention to a most important point in connection with the possible obstruction of through traffic routes by reason of business developments immediately adjacent to the pavement or traveled way, reducing thereby the traffic capacity of these highways by stopped or parked cars.

I have for some time felt dubious as to whether or not the socalled "Freeway" is a proper answer to this problem, not only by reason of the added cost of rights-of-way but also because of the reduction of taxable values and the prevention of those business developments and businesses for which, as Mr. Dean says, there is evidently an economic demand and justification. His suggestion of an adequate setback line I believe is worthy of serious consideration.

New York, N. Y., F. LAVIS
June 28, 1937

Closure Fill at Fort Peck

Sir: In Engineering News-Record, July 8, 1937, p. 50, there appeared as the first item in the editorial pages certain comments on the Fort Peck Dam which are incorrect and misleading. I refer particularly to the statements:

"To build the flanking sections by hydraulic fill, the ends at the gap left to carry the river had to be constructed of dry fill. These two fills form zones through the dam that sever the hydraulic fill with its middle core of water-deposited material into three parts. Unless the bond between these parts is sound and tight, a definite hazard to the dam will develop as hydrostatic head piles up with the filling of the reservoir."

The facts are that the ends at the gap left to carry the river were constructed of hydraulic fill. There has never been any question in my mind, or any question raised by engineers who have visited this project, but that a perfect bond will exist between the hydraulic fill of the river slopes and the fill at present being deposited in the closure section. The correctness of this statement, I believe, would be apparent to any one observing the present operation.

Fort Peck, Mont. T. B. LARKIN
July 15, 1937 Lt. Col. Corps of Engineers
District Engineer

[No question was implied that the engineers at Ft. Peck had not considered the problem of bonding the closure fill or were not confident that the methods planned were adequate. The end fills next to the closure gap are however constructed by dragline and bulldozers of material from the beaches of the adjacent hydraulic fills; they are fills of rehandled water deposited materials but are in no sense hydraulic fills. —EDITOR]

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JULY 22, 1937

ADD TO ENGINEER'S NOTEBOOK the caution that it is important to question benchmarks and to adjust sewer grades to possible ground subsidence. The record of three and a half years' settlement at La Verne, Calif., confirms prior observations in the San Jose region and in South Dakota of material subsidence following long-continued lowering of groundwater by pumping. Since O. E. Meinzer some years ago found that pumping caused water-bearing strata to compress by removing the buoyant effect of the groundwater, a conclusion supported by observations in some oilwell areas, it has become increasingly obvious that the axiom of benchmark fixity does not always hold. Also, the changes of level may check or interrupt gravity flow in pipe systems such as sewers, unless the pipe grades are so laid out as to make advance provision for slope changes. In short, the unchangeability of terra firma in which we have all believed is only an approximation. Geodetic experts first disproved the unchangeability of terra firma by discovering isostatic adjustment, and now the everyday surveyor finds that actions nearer the surface may produce even faster change. The prudent engineer will keep such topographic variation in mind.

Wasted Effort

IN VOTING DOWN, in routine and perfunctory manner, a new specification for blended cements, the A.S.T.M. convention a few weeks ago did injustice to its reputation for thoroughness. Perhaps it is inaccurate to say that the "convention" rejected the proposed specification, for the vote, 15 to 13, represented only about 25 per cent of the persons in the room. But the lack of discussion, pro and con, was amazing. There simply wasn't any discussion. To put the matter briefly: the specification upon which the committee had previously cast 42 affirmative and 17 negative votes was offered to the meeting, there were not enough takers, and in consequence there is no blended cement specification. This does not mean there will be no blended cements. On the contrary, there are blended cements, and each year sees their tribe increase. Lack of a specification, however, leaves the door wide open for all sorts of "patent medicine" whose unrestricted use can only result in poor structures or an economic loss or both. Consumers who see in blended cements properties that can be used to advantage deserve every aid that the A.S.T.M. can give them. If this specification was not satisfactory its shortcomings should have been aired. A sit-down strike on discussion benefits no one.

Local Factors

SOME OF THE DIFFICULTIES that surround flood-protective planning were brought to clear view by H. K. Barrows' recent discussion of the proposed flood-control works for the Connecticut and Merrimack rivers. The condensed presentation of Prof. Barrows' statement in this issue points to the main difficulty, namely that river improvement for a single purpose differs widely in cost and return from development for several joint uses. His figures, which are those of the Water Resources Committee, indicate that flood protection by itself is much too costly to be justified by the saving of flood damage, while a joint-use project is shown to be a good investment on either river. It may be concluded that the local factor in flood planning is too important to be ignored with safety; the result may be waste of money as well as permanent waste of essential water resources. It will be interesting to see how successfully the New England Commission is able to co-operate in the federal flood-control work: the outcome may mark out the lines of effective river planning applicable to other regions.

Garbage and Hogs

CITIES that dispose of their garbage by hog-feeding seldom boast about it—and in most cases they have good reason not to. Although this is the most widely practised method of disposal, the manner in which it is generally conducted is not only an abomination but an actual menace to health. This raises the question: Can hog-farm garbage disposal be successfully operated without nuisance? The answer is yes; the reasons are clearly presented in the article describing Flint's municipal piggery. Experience at Flint over a period of two decades indicates that the business is highly specialized, requiring a knowledge of animal husbandry as well as an appreciation and conscientious observance of sanitary cleanliness. Since many communities will for a long time continue using this method, it ought to be made as efficient as possible. To this end municipal officials should insist on proper management of existing hog-farms, patterned, perhaps, after the Flint system.

Abatement by Law

PENNSYLVANIA has taken a progressive step forward in stream pollution abatement in passing the La Rue bill. This act strengthens existing laws

and puts into the hands of the Sanitary Water Board of that state an effective instrument to restrict waste discharges—municipal and industrial—which would be detrimental to water supply, public health, animal or aquatic life, and recreational uses. The board is empowered to compel the installation of remedial works. All industries discharging wastes must file with the board within 90 days complete information as to kind and character of the wastes, except as respects acid drainage from active mines. The La Rue bill is broad and extends almost unlimited authority to the Board. Legislation alone, however, will not solve the problem of pollution; many factors which cannot be changed overnight must be taken into account before complete reform is accomplished. And unless the law is administered with good judgment and discretion serious economic consequences may result. The actual results of the Pennsylvania anti-pollution measure therefore depend as much on its administration as on the terms of the law.

Against the Public

IN THE KALEIDOSCOPIC drama of labor trouble bred by the Wagner Act there now are indications that the public is beginning to assert its rights. Though government officials as yet appear to be unaware of the fact, the test of public interest is being applied to labor disputes more critically every day.

At present this test of public interest challenges particularly the jurisdictional strike, worst element of labor warfare. From its birthplace among the building crafts this type of strike has spread to other types of craft and industry, among others to motor production and newspaper publishing. In no case does it do anything to better the position of labor as against employer. It does not give labor a larger income, either in dollars or in production. It merely enables one labor group to gain an advantage over another labor group, wholly at the cost of the public.

Strikes are bad enough at best, and when carried on in disorder and violence, encouraged by official inaction or support, they become the most serious threat to organized civilization that the country has experienced. But of all kinds of strike the jurisdictional strike has less excuse than any, especially when the fight is not between rival crafts but between rival labor trusts. As the worst complication of the labor situation now in sight, it should be outlawed by penal legislation.

Labor, which could control and eliminate jurisdictional strikes, has done nothing about them. The record moreover destroys the hope that it either desires or intends to do anything. In view of this fact jurisdictional strikes acquire a public status and call for public action to suppress them, the more so as their essence is oppression to prevent one group from working as it desires to work.

Group oppression is a treacherous foundation for lasting settlement of labor problems, and for this reason the jurisdictional fight is an unmitigated evil even from the viewpoint of labor alone. When, however, the oppression directs itself not only against a group but against the public at large, public action to wipe it out becomes imperative. It is necessary then to place formal legal responsibility on labor organizations and their members, and hold them answerable for actions so hostile to the public as jurisdictional strikes.

The Second Half Century

A NOTABLE RECORD of growth and usefulness has been achieved by the Engineering Institute of Canada in its first half-century of existence. At the recent celebration to commemorate the semi-centennial of the Institute's formation this record was fittingly reviewed and praised. May the Institute continue to be the standard-bearer of engineering progress in the Dominion.

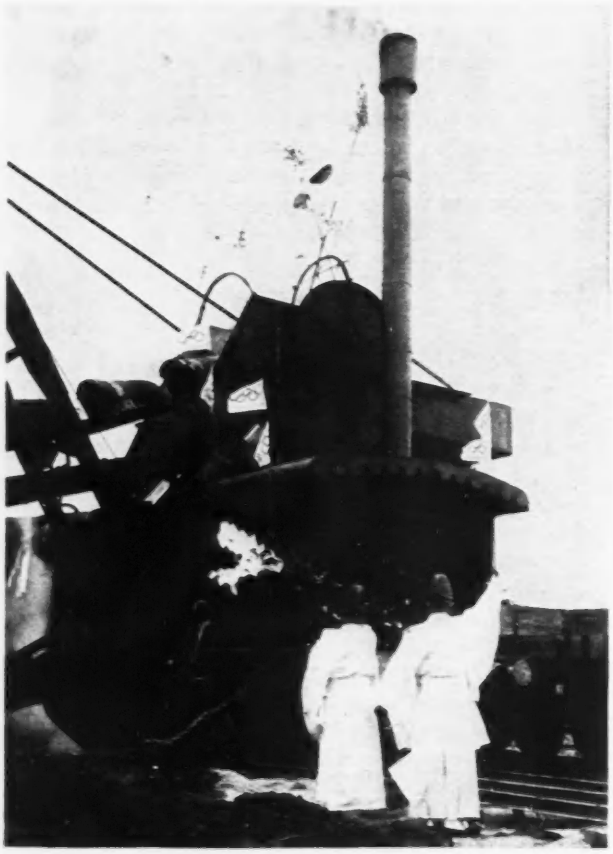
The new movements that are stirring engineering circles in Canada are not without relation to the Institute's future. The growth of the provincial associations of professional engineers has raised the direct question whether these bodies should consolidate with the Institute. Unfortunately the program of the Institute's semicentennial meeting contained no reference to this subject. Yet it can hardly be doubted that questions of the kind are likely to play a large part in the Institute's second fifty years.

On both sides of the border the rise of professional societies presents the issue whether technical and professional activities shall be integrated or whether they shall remain apart. It is an issue well worthy of discussion as an organization looks a half-century forward into the future.

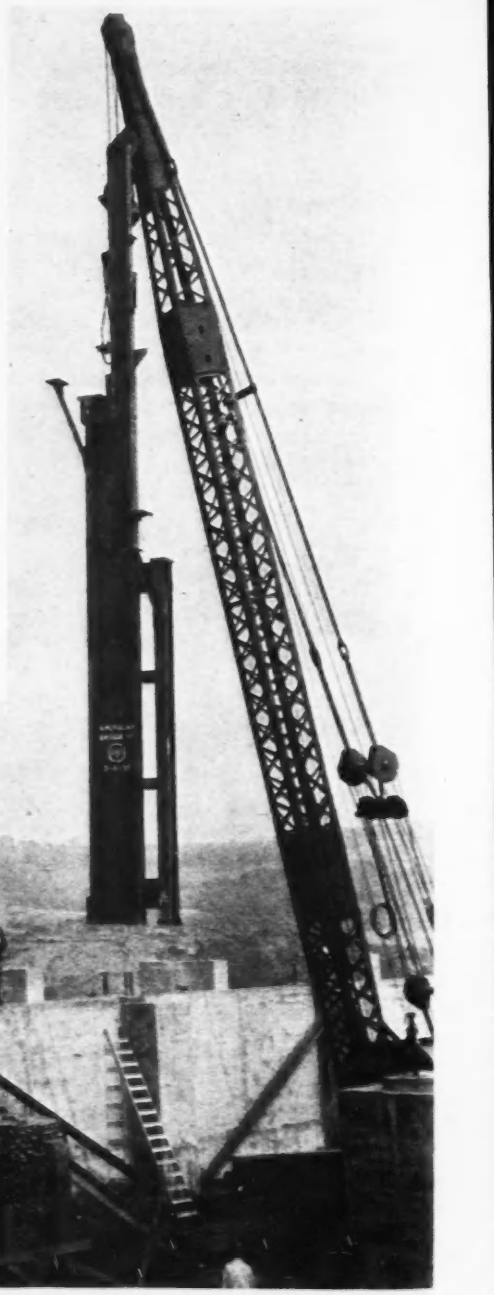
Canada, with its somewhat simpler system of engineering organization, has seen the movement toward integration advance nearly to the point of adoption; it was only by a narrow margin that the Institute sometime ago failed to adopt new bylaws that would have initiated this integration. But the problem was not solved by this vote; it remains a current problem in the Dominion as it does in the United States.

Frank discussion of the subject at the Institute's semicentennial might well have set a course for the half-century that lies ahead. It may be hoped that such discussion will soon be carried through, so that clearer thought on the possibilities of a single technical and professional center may emerge. Whatever conclusions are reached by the Canadian profession, they may prove to set a precedent for action by their colleagues to the south.

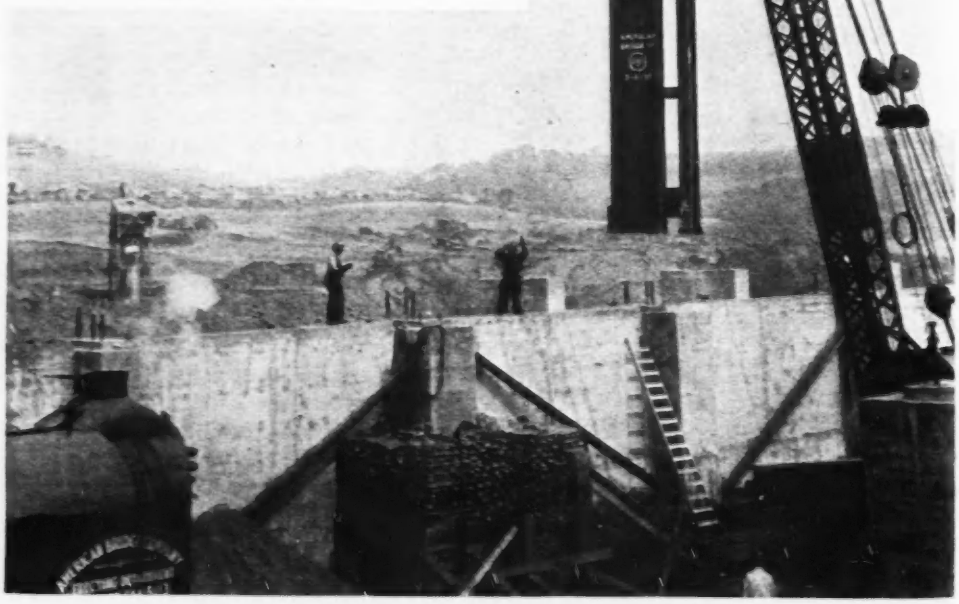
PICTURES IN THE NEWS



THE FIRST STEEL *for the Irvin Works of the Carnegie-Illinois Steel Co. near Clairton, Pa., was set on July 8 by a construction gang of the American Bridge Co., 46 days after ground was broken for the project. The 45-ft. column weighs six tons.*



JAPANESE, *when they undertake a big project, make a religious ceremony of the start of construction. Here Shinto priests are consecrating a dredge starting work on the grounds for the 1940 Olympic Games.*



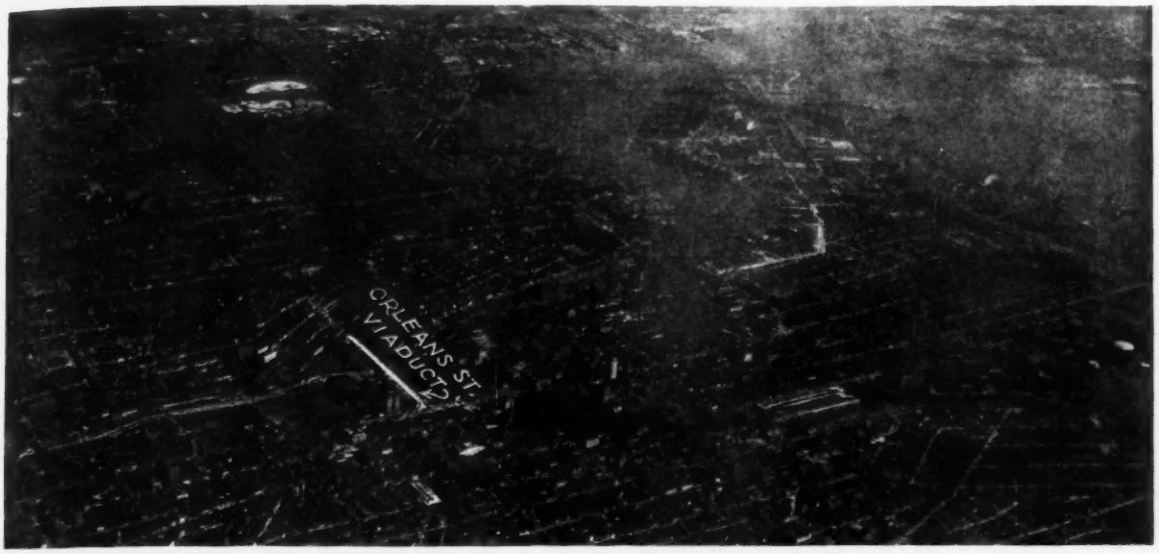


FIG. 1. ORLEANS ST. VIADUCT PROVIDES AN EFFECTIVE TRAFFIC BYPASS AROUND BALTIMORE BUSINESS DISTRICT.

Baltimore Builds A Viaduct

by GUSTAV J. REQUARDT
Whitman, Requardt & Smith, Consulting Engineers

AND

HERMAN J. LUCKE, JR.
Bureau of Highways, Department of Public Works

[Baltimore, Maryland]

Behind the operations that made the Orleans St. Viaduct a reality were problems of public opinion and policy no less difficult than the actual construction

THIS is the story of a city viaduct and how it came to be built. Not unique of itself in either structural or engineering features, the Orleans St. Viaduct in Baltimore nevertheless has engineering interest, and the problem of getting the improvement accepted, built and used should be of interest to engineers in other cities, whose citizens are reluctant to see any change in established conditions.

Baltimore is very conservative. It enjoys familiarity with its street layout, and the necessity for changes has to be proven twice over before they will be adopted. Baltimore is more like London in this respect than probably any other American city, and we all know how Londoners argued for one hundred years before they would allow a new Waterloo Bridge to be built.

The topography of Baltimore consists of a number of watersheds with rather steep hillsides leading down to the original streams. Extending northward from the harbor, the principal valley is that of Jones Falls. Fayette St. (Fig. 2) crosses this valley at a reasonable grade, but east-and-west streets north of here are steep and difficult to negotiate. The next street north with an easy grade is Eager, three-quarters of a mile above Fayette, and this crosses the bottom of the valley on a bridge.

Most of the through traffic used Fayette St., so that much thought had been given to developing another through street to relieve the heavy congestion. Further, the difficult-to-cross strip between Fayette and Eager, dividing the main shopping district on Charles St. from the older part of the town on the east side, was holding up local traffic to the detriment of various parts of the city.

Two locations proposed

It was conceived that an east-west viaduct crossing the Jones Falls Valley somewhere between Fayette and Eager was necessary. The battle was joined when the exact location was discussed.

A legislative enactment, passed in 1924, permitting Baltimore to build a "Franklin Street Viaduct" was approved by vote of the citizens in 1928. Everybody thought of the viaduct as crossing St. Paul and Courtland Sts. at right angles and, as the need of such a structure was evident, all were resigned to it since it would require a minimum amount of grass to be removed from Preston Gardens. The gardens form a narrow strip of park between St. Paul and Courtland Sts., from about Fayette St. on the south to Center St. on the north, which had been created 20 years ago to replace some old buildings. Much discussion accompanied the development of this park but, after the shouting and cross-purpose criticism died down the citizens found they had a delightful and well-engineered width of flowered, treed and grassed park in the heart of the

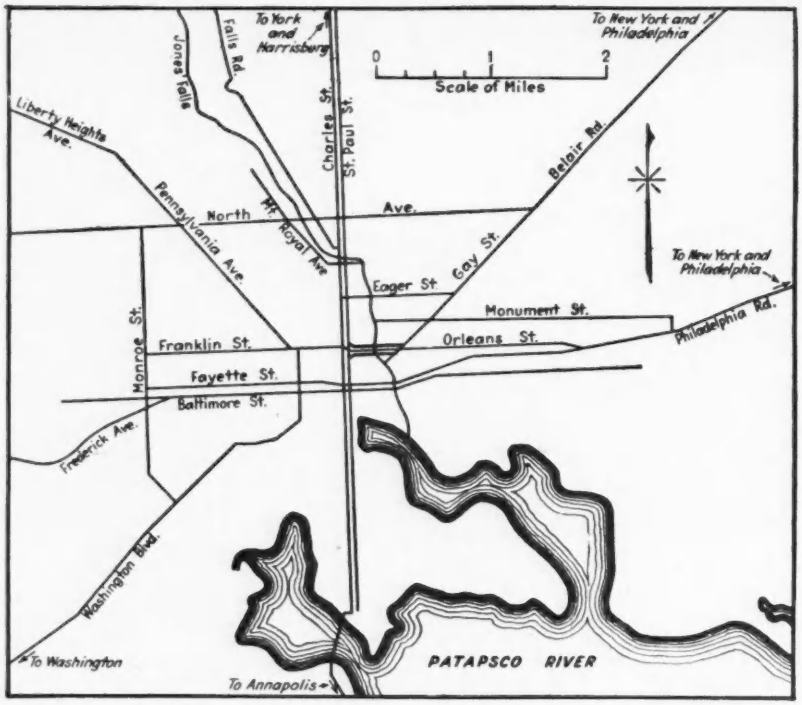


Fig. 2. **The street pattern of Baltimore into which the Orleans St. Viaduct has been effectively fitted. The viaduct location is indicated by heavy lines parallel to an extension of Orleans St.**

town, and they became justly proud of it.

In spite of some agreement on the Franklin St. route, however, Charles F. Goob, then chief engineer of the department of public works, and his assistant, Frank K. Duncan, presented a plan in the spring of 1929 to place the viaduct along Bath St., 240 ft. south of Franklin St., and to join Franklin at St. Paul at about a 45 deg. angle. A wye-leg was to join St. Paul at right angles to take traffic coming northward. The viaduct eastward was to rise on an overpass over Courtland, turn due east and land at Gay St. on a line with Orleans. Courtland was to be widened by cutting off a 10-ft. strip of grass in Preston Gardens so that this street could be used for north and south traffic. Mr. Goob even proposed to move the venerable Battle Monument to the grass plot in the wye from its long-time location in the middle of Calvert St. just north of Fayette. In this latter thought the engineers were "born 30 years too soon."

Discussions wax hot

On these proposals Baltimore vigorously divided itself into three schools of thought: (1) No viaduct at all; (2) The Franklin Street right-angle viaduct; (3) the Orleans St. route.

The Franklin St. group was by far the largest and most vociferous. Any other but a right-angle crossing was considered poor engineering. This route passed near the second and third story windows of a big office building (Fig. 3) and air-rights over the large Western Maryland Dairy property would have been necessary. The route led into Monument St., on which there will be maintained trolley and freight car tracks for many years, and Monument passes through the area occupied by the famous Johns Hopkins Hospital buildings. The east end of this route is not advantageous for through traffic from Philadelphia to Washington. Nevertheless, the right-angle group considered it the best and put up a very determined fight.

Mr. Goob discussed his plan early and late, met with civic clubs and threshed his scheme out with individual prominent citizens. He received reluctant consent, and the administration started buying the necessary land.

In the meantime, the "No Viaduct School" was not idle. Perhaps Henry L. Mencken, the satirical sage of Baltimore, was the most effective of this group. His position was that through traffic should not come into Baltimore anyway, and if it did, let it find its own way; that peregrinations of citizens through the town should be by easy stages, stopping to talk town gossip with acquaintances on the way; that the cost was far out of proportion to the benefits obtained, and that it was a shame to soak John Taxpayer for the benefit of the forward-lookers.

On Mayor Jackson's being re-elected in 1931, and with most of the right-of-way purchased along the Orleans or Bath St. route, the Old Town merchants pushed for action. Some of the real estate necessary had been purchased at prices as much as ten times the assessed valuation, and this offered meat for juicy gossip. Several suits were instituted in the courts, but no one was indicted and the net conclusion of the verdicts was that, in general, the land purchases had not been unreasonable. Mayor Jackson felt it was necessary for him to go ahead on a project which was the least expensive at that time and, with most of the land purchased, the Orleans St. route was naturally selected.

A 16-year history

A chronology of the events related to the viaduct would read somewhat as follows:

1920—First suggestions of a Jones Falls Valley crossing between Fayette and Eager Sts.

1924—Legislative enactment.

1926—Agitation for bond issue.

Nov. 1928—Bond issue of six million dollars successfully carried for viaduct and other street work.

Dec. 1928—Bath St., Franklin St. and a modified Franklin St. route described and compared in costs. The Bath St. structure estimated at $1,032,000; land, $590,000; paving, $30,000; or a total of $1,652,000.

May, 1929—City engineer recommends Bath or Orleans St. route. A majority of a citizens' committee appointed by the Mayor approves.

Sept., 1929—Traffic engineering firm, employed to study the situation, favors the Franklin St. route.

Oct., 1929—Association of Commerce changes its position and favors the Bath St. route.

Oct.-Dec., 1929—Many acrimo-

monious hearings before city council.

Dec., 1929—Municipal Art Society employs Frederick Law Olmstead who reports in favor of Bath St. City council passes ordinance for land acquirements on this route.

Jan., 1930—Consulting engineers appointed, who, with city engineers, begin detailed study for contract plans and specifications.

Aug., 1930—Suit filed to restrain city from harming or destroying Preston Gardens. Much land already purchased.

Sept., 1930—Estimate of land cost $1,740,000, or nearly three times the original estimate.

Oct., 1930—Another suit filed charging illegality in buying land, while a restraining suit is pending. Plans and specifications practically completed. Later in month, court rules city has illegally paid for $1,200,000 of land, but the court does not void the ordinance.

Dec., 1930—To clear atmosphere, city council passes a supplemental ordinance.

June, 1931—Mayor is told city can get back $1,000,000 already paid for land for the Bath St. viaduct if the plan is abandoned. City engineer now estimates the viaduct at $1,225,000; land, $1,870,000; paving and contingencies, $48,000; or a total of $3,143,000. Mayor appoints an investigating committee which in July advises the abandonment of the Bath St. route in favor of the Franklin St. route.

Aug., 1931—Probers study large payments revealed in city auditors' report as having been given to a city official. Grand Jury decides to act. President of the commissioners for opening streets formally quits his post. Former mayoralty administration faces investigation. Old Towners challenge statements of mayor's committee that $1,250,000 could be saved by going to the Franklin St. route.

Sept., 1931—Grand Jury returns indictments against former city councilman and officials and citizens whose land was purchased by former administration.

Jan., 1932—Grand Jury has decided there was no fraud intended in awarding $345,000 for certain properties along Bath St. route. Indictments appear to be quashed.

July 20, 1932—Mayor says Bath St. is to be built.

1933-1934—City applies for federal funds. PWA and Bureau of Public Roads study whole situation and approve the project.

August, 1934—The Maryland State Roads Commission takes over the Bath St. project as part of its PWA program and awards the contract for $894,400.

Jan., 1936—Viaduct completed and put into use. Final construction cost $843,872.59, not including land.

Viaduct in service

The viaduct is now built and has been in use for over a year and a half. Street car tracks have been taken off Franklin St. to the west and Orleans St. to the east. At the eastern end, the street has been extended through two old cemeteries and makes an easy connection with the Philadelphia Road. At the west, Franklin St. connects with Monroe which is a through-traffic street to Washington boulevard. Traffic confusion at the famous 45-deg. angle at Franklin and St. Paul has been much less than that predicted. The viaduct route has proved a success and is being used by ever increasing numbers of citizens and by through traffic. It is conceived that few people, even including Mr. Mencken, would say that the viaduct is not of any distinct value to Baltimore.

The viaduct is 2,075 ft. long including the approaches. Its concrete deck accommodates a 54-ft. roadway, and two 6-ft. sidewalks. East approach consists of a compacted sand and gravel fill between reinforced concrete retaining walls. Viaduct consists of four lines of deck plate girders in 18 spans ranging in length from 67 to 110 ft. Passing over a dozen streets in the valley and the Preston Gardens, it comes to grade by means of a wye approach at the east curb line of the upper level of St. Paul place. Maximum height of viaduct roadway is 49 ft.

Substructure and two-column bents are reinforced concrete. Walls, piers and abutments adjacent to Preston Gardens are faced with brick panels and limestone.

The design of the structure was executed by Herman J. Lucke, Jr., bridge engineer, Baltimore department of public works. Bernard L. Crozier is chief engineer of the department. Whitman, Requardt and Smith, Baltimore, were consulting engineers, and William H. Emory, Jr. consulting architect. Construction was supervised by the state roads commission, Nathan L. Smith, chief engineer, and E. H. Nunn and Ben Le Seur, resident engineers. The Fuller Construction Co. was the general contractor, and the American Bridge Co. subcontractor on the steel.

Fig. 3. High above the Jones Falls Valley, the Orleans St. Viaduct provides a 54-ft. roadway for traffic that finds an exit to the shopping district over an elevated wye at St. Paul and Franklin Sts.

Ground Subsides on 2-Mile Line

Level differences up to 1 ft. ascribed to compaction of soil strata when water table lowers 100 ft. at La Verne, 35 miles east of Los Angeles

GROUND SURFACE subsidence along a 2-mi. length of the Colorado River aqueduct distribution system some 35 miles east of Los Angeles has been observed as it has progressed during a 3½-year period. In that time the maximum difference in levels has been slightly less than 1 ft. A notable parallel with the similar (though more extensive) subsidence in the Santa Clara Valley (*ENR* April 1, 1937, p. 479) appears in the rate of settlement. In the Santa Clara Valley the settlement has been 4.84 ft. in 16 years; on the aqueduct, 0.98 ft. in 3½ years—close to 0.3 ft. per year in both cases. The following information relative to the subsidence in southern California was supplied by R. B. Diemer, engineer of distribution, Metropolitan Water District of Southern California, under whose direction the subsidence measurements have been made.

Periodical check on benchmarks along the aqueduct route began in June 1933; the progressive settlement along a devious route 2 mi. in length is indicated in Figs. 1 and 2. Maximum settlement of approximately 1 ft. was recorded just northeast of the city of La Verne. In this area the aqueduct distribution line consists of a precast concrete pipe 11½ ft. in diameter with steel lock joints calked with lead gaskets. As the aqueduct will be under pressure no reduction in carrying capacity would result from continued settlement and it is believed that the flexibility of a joint of this type will accommodate any settlement.

The exact time when the subsidence started is unknown, but Alva Smith, city engineer of La Verne, knew of it six years ago. On Feb. 26, 1931, he noted that the U. S. Coast & Geodetic Survey benchmark at 3rd and D streets in La Verne was 0.705 ft. lower than when it was checked in 1923. Another street intersection, four blocks east, showed a settlement of 11 in. for the same period. Later, when the county road department paved Fourth St. through La Verne it was noted that the block between Park Blvd. and B St., which originally had a fall of 1 ft., no longer had any grade at all. Sewers have not been affected as yet, the city engineer reports, because of their rather steep grade, but a continuation of the present settlement will affect sewer grades within a few years.

In 1931 the city of La Verne took over from a private owner a well (marked *A* in Fig. 1) which had been drilled in 1928 to a depth of almost 1,000 ft. In 1932 it was noted that the foundation had settled away from the pump leaving the well casing protruding about 3 in. The casing then was cut off 2 in. inside the foundation. Since then no further displacement has been noted. Mr. Smith is of the opinion that the subsidence is the result of lowering groundwater and that the alluvial material has compacted and settled during the drying-out process. Water levels in this locality have dropped 100 ft. in 10 years.

R. L. Davis of the La Verne Water Association operates two wells in the vicinity (*B* and *C* in Fig. 1), 790 and 820 ft. deep respectively. No difficulty has been experienced with well *B*, but in 1933 well *C* collapsed and either sheared or constricted the casing with the result that on withdrawal of the pump the suction pipe broke off and remained in the well, necessitating installation of a smaller pump. Mr. Davis reports that joints in a nearby 18-in. concrete pipe line broke so frequently that recently the line was taken up and replaced with steel. Neither of these difficulties is definitely known to be the result of the ground subsidence but have every appearance of being caused by it.

Richard Anderson, superintendent of the Evergreen Ranch, operates several wells in the vicinity including those marked *D* and *E* in Fig. 1. The alignment of well *E* has gradually changed since 1933 and recently became so crooked that it was abandoned. The casing in well *E* collapsed but use of a smaller pump was possible. This ranch has had many broken joints in concrete pipe lines; in a new line recently installed to replace one with many broken connections, joint trouble has continued.

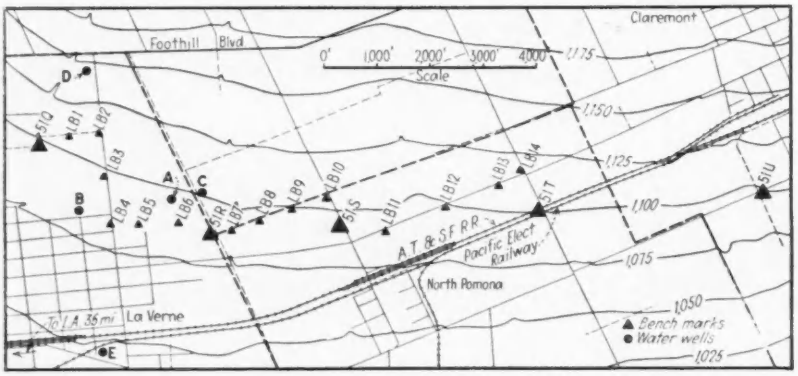


Fig. 1. Map showing location of benchmarks and wells where subsidence was noted.

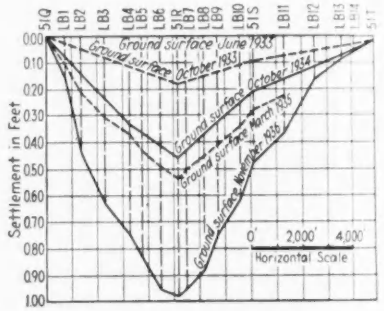


Fig. 2. Diagram showing settlement at benchmarks along the 2-mi. length of the level survey route.

Garbage Disposal by Hog Feeding

by James R. Pollock

Director of Public Works and Utilities, Flint, Mich.

Low cost of waste collection and disposal services at Flint, Mich., attributed in part to sizable revenue returns from carefully managed hog-farm operations

For nearly 20 years Flint, Mich., an industrial city of 165,000 population, has operated a municipal waste collection and disposal division and has disposed of its garbage by hog-feeding. This method of disposal is probably more widely practiced in the United States than any other means, yet there is very little written about it. Many inquiries concerning hog-feeding procedure and results are received by the department and this article, therefore, has been prepared as a summary of the city's experience in waste disposal with particular emphasis on hog-farm operation.

Residents of Flint are provided with collection service of garbage and other wastes financed by the general tax budget. For garbage collection purposes the city is divided into 33 routes during the summer months and 42 routes during the winter period. Twelve 1½-ton 4-yd. dump body trucks are operated in the summer and eight similar trucks during the winter. Each truck operates with two collectors who also act as drivers. Collections are made from the rear of every house, twice weekly from May 15 to Nov. 15, and once weekly during the remainder of the year. Garbage from the 300 hotels and restaurants in the city is collected six days per week.

Garbage transfer

All garbage is taken to a central station for transfer into trailers for transportation to the city hog farm. This transfer is made by dumping from an overhead platform directly into trailers which are then hauled to the farm by a truck tractor of sufficient capacity to transport two complete units, each unit consisting of two tanks having a capacity of 7 cu.yd. each. When heaped with garbage the gross load of a train is as much as 50 tons per trip.

The city has encouraged householders to place empty food tins, broken glass and small metal objects in separate containers placed at the rear of the house. This can collection service is provided for with a fleet of seven trucks of the same style and capacity as used for garbage. Each truck is operated by a driver who is also the collector. Experience has proved that a frequency of service of about once in five weeks is quite satisfactory. Cans and rubbish are disposed of by dumping on low land for filling purposes. The city has experienced no difficulty in recent years in securing dumping places in return for salvage privileges to the owner or operator of the dump.

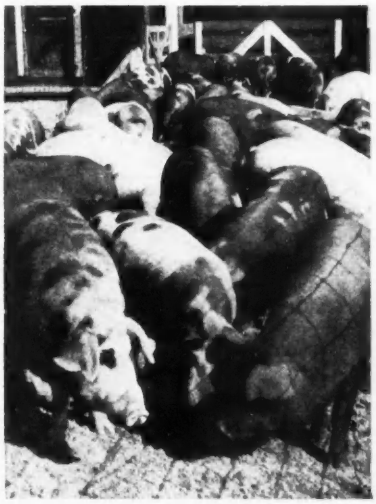


Fig. 1. Porkers ready for market after fattening on Flint garbage.

In addition to the regular can collection service, there is an annual "Clean-Up" campaign sponsored by the Junior Chamber of Commerce. This campaign produces a great volume of rubbish of all sorts to be removed by city forces during the two weeks it is in effect.

Ash collection service given by the city provides once-a-week collection. For this purpose four trucks, used in the summer time for garbage collection, are employed. Property owners are required to place their ashes at the curb line in proper containers. The ashes are used for surfacing unimproved streets, of which Flint has a large mileage. Usually the first three ash collections in the fall and the last two collections in the spring contain nails and other undesirable debris and during these periods the ashes are used only for fill purposes.

Hog farm layout

The city hog farm, located 12 miles from the transfer station, comprises 270 acres of land the soil of which is sandy in nature and lends itself to good natural drainage. The buildings on the farm consist of a large feeding and shelter barn, 100x300 ft. in plan, constructed with a concrete floor throughout. In the sleeping quarters (large enough to house 2,500 hogs) wooden platforms are laid on top of the concrete. This type of floor has been found preferable to bedding down directly on the concrete floor. In addition to the large barn there are smaller buildings consisting of an office and scale house, tool shed and granary, hospital building, water tower and living quarters for the farm foreman. The total investment for land and buildings is $140,000.

The city makes no attempt to raise feeder pigs, as it is believed that young pigs can be brought to the feeder age much better by others and on premises where the risks involved

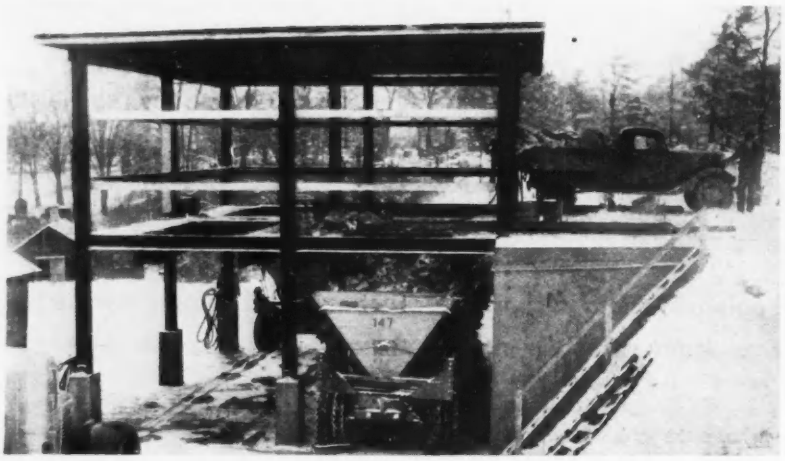


Fig. 2. Transfer station in the city where trailer trains are loaded for the farm which is located 12 miles away.

Fig. 3. Garbage is transported to the farm in trailer trains which carry as much as 50 tons per trip.

Fig. 4. Sleeping quarters in the barn are clean, light and airy; raised wooden platforms covered with straw are placed over the concrete floor.

are not so great. For the past four years feeder pigs have been purchased in both the Detroit and St. Paul markets. Prior to 1933 young pigs were purchased exclusively from Western sources because it was the firm conviction of municipal authorities that native pigs would not live on garbage. This theory was entirely exploded by the purchase of feeder pigs on the Detroit market in 1933 and since that date thousands have been purchased from this source with results equally as good and in some instances better than with Western-bred animals.

Feeder pigs are preferred weighing about 125 lb. each, as at that stage of development they can best withstand shock from vaccination (to prevent spread of hog cholera) and seem to acclimate themselves to the garbage diet more readily than lighter-weight pigs. Inasmuch as the average period from the date of receipt of pigs until the date of sale is four months, a heavier vaccination dose of serum and virus is required than would be used were the pigs fed on a corn diet. The rate of weight gain with a garbage diet is less than the rate of gain where corn is used.

Loss of weight

A rather important item in connection with the purchase of feeder pigs is the loss of weight that takes place after vaccination (which is done at the point of purchase) and during the 24-hr. period that precedes their shipment. This shrinkage from time of purchase to arrival at the farm averages about 7½ per cent—on pigs coming from the Western markets this will be about 10 per cent because of the long haul. The shrinkage represents pounds of pork which must be replaced and actually, on the basis of 10c pork, represents an additional cost of one cent per pound.

As soon as the feeder pigs arrive at the farm they are placed in quarantine. During this isolation period of three weeks extra care is given and particular pains taken not to overfeed. The ration during this period consists of medicated oats with a small amount of garbage. Experience has shown that the mortality rate will be less if hogs are kept hungry rather than overfed. It is highly important to provide well-ventilated quarters, a good supply of clean running water, and sleeping platforms well-bedded so that the animals are as comfortable as possible.

During this period of three weeks the pigs will lose in weight and it usually takes another two weeks after quarantine before they will regain the weight lost. From that point on the rate of weight gained per day increases rapidly. Pigs initially weighing 150 lb. will gain ¾ lb. per day; at 200 lb. weight they gain

Fig. 5. Shelter and feeding barn which houses 2,500 hogs is constructed of steel and sheet metal. The building covers an area 100x300 ft. and is a well-ventilated structure.

1 lb., and when they reach 250 lb. weight they will gain 1½ lb.; gains of 2 lb. per day are not unusual. These groups of animals will consume, respectively, about 15, 20 and 25 lb. of garbage per day regardless of the quantity placed before them. The average gain per day is about 1 lb. from date of receipt to time of sale.

Care of sick pigs

Either from the effects of vaccination or from the garbage diet some animals in each new lot will not do so well. Animals which develop ulcers, become lame or otherwise "go slow" are sorted out and placed in the hospital, where extra care is given This extra care results in a considerable percentage of recovery, after which the rehabilitated hogs can be turned back with the regular groups.

The two diseases which have caused the most deaths during the past ten years are influenza and enteritis. During the summer of 1936 an outbreak of enteritis added considerably to the death rate for the year. This epidemic was rather widespread and encountered in many feeding lots in 1936. Influenza and lung troubles are problems during the winter months, particularly with changing weather conditions. The average annual death rate from all causes during the last ten years was 8.36 per cent; during this period a total of 75,729 pigs were handled at the farm. The death rate has varied from 4.71 to 13.24 per cent in different years.

During the years when the death rate exceeded 10 per cent an unusual condition existed in that epidemics of influenza and enteritis gained a foothold in the herds. According to the best information received, an average annual death rate of 10 per cent in herds as large as those maintained by Flint is not unusual. Present prices for grease and tankage make it possible to sell the dead animals to a rendering plant at $1 per head, the company picking them up at the farm. When there is no market for dead animals they are disposed of by burying.

In ordinary routine on the farm the hogs are divided into groups depending upon size and weight. It has been found unwise to have more than 400 animals in any one group, and operations at the Flint farm are arranged for 7 or 8 groups. Once a week sorting is done in an attempt to keep the various groups as nearly the same weight within the group as possible. During the summer months cool or cloudy days are selected for sorting operations because a hog is easily overcome with heat. Besides, the animals may lose several pounds in weight if not handled with care.

The city department of finance makes an official inventory once a year but routine inventories are made every few months by the public works department to determine the number feeding and weight gains. The number of animals maintained varies considerably depending on the season of the year. An attempt is made to keep on hand sufficient animals to properly consume all garbage collected. The variation may range from 1,500 in the winter months to 3,000 in the summer and fall months.

Marketing procedure

A great deal of attention is paid to the sale of hogs to secure the maximum return for the city. For several years practically all sales have been on the Detroit market or to serum companies. Flint is located 65 miles from Detroit and the pigs are transported there in trucks. This is the most desirable method of transportation, inasmuch as the shrinkage does not exceed 1½ per cent as compared to 5 per cent when shipped by rail.

Animals are developed to the weight classification which will produce top prices during the year. This ranges from a minimum of 240 lb. to a maximum of 280 lb. per animal. Native pigs finish at a weight of 225 lb. while Western pigs are not in the finished stage until they reach 250 lb. or more. Close contact is maintained with a commission house and packers to adjust the weight of the hogs to that figure which will produce maximum revenue.

During the past two years a large number of hogs have been sold for serum purposes. These animals are the most select ones on the lot and must have full ears and long tails in order to answer the requirements of the serum companies. On such sales a premium is received as compared with open market returns.

Farm care and maintenance

Farm operations are so conducted that during a considerable period of the year the hogs can be fed from concrete floors or platforms; in the summer months, however, a considerable amount of the garbage is dumped directly on the ground in the feeding lots. The schedule of operations is planned so that the ground on each feeding lot can be plowed under twice during the season and "rested" for 3 or 4 weeks before it is used again. Complaints about odors are rare.

WASTE COLLECTION AND DISPOSAL COST AND QUANTITY DATA

	1930–31	1931–32	1932–33	1933–34	1934–35	1935–36
Total Cost	$143,966.57	$118,044.77	$91,609.73	$80,293.23	$85,960.95	$98,853.28
Less Diff. Hog Pur. & Sales [1]	9,207.74	8,425.86	12,524.84	15,298.56	25,627.16	35,361.60
Net Expense	$134,759.83	$109,618.91	$79,084.89	$64,994.67	$60,333.79	$63,491.68
Population	156,422	156,422	148,000	145,000	150,000	156,492
Cost per capita (gross)	$0.920	$0.755	$0.619	$0.553	$0.573	$0.632
Cost per capita (net)	0.862	0.701	0.534	0.448	0.402	0.406
COST PER CAPITA (GROSS)						
Garbage collection	$0.524	$0.432	$0.359	$0.334	$0.327	$0.351
Tin can collection	0.18	0.156	0.105	0.115	0.086	0.112
Ash collection	0.05	0.041	0.045	0.042	0.043	0.056
Garbage disposal	0.153	0.112	0.097	0.109	0.105	0.101
Dead animal removal	0.013	0.013	0.011	0.01	0.012	0.013
TOTAL QUANTITIES						
Garbage (tons)	17,636	18,887	17,742	15,030	19,028	21,916
Cans (cu. yd.)	28,416	25,350	25,290	24,769	28,282	35,459
Ashes (cu. yd.)	21,416	28,048	24,214	17,403	20,907	26,388
Animals (lb.)	5,509	5,823	5,829	6,653	8,764	11,533
QUANTITIES PER CAPITA						
Garbage (lb.)	225	241	240	209	254	280
Tin cans (cu. yd.)	0.182	0.162	0.171	0.171	0.189	0.227
Ashes (cu. yd.)	0.137	0.179	0.164	0.12	0.139	0.169
Average sales price per lb.[2]	$0.076	$0.044	$0.033	$0.0416	$0.0681	$0.1009
Average purchase price per lb.[3]	0.098	0.077	0.053	0.0456	0.0769	0.1174

[1] This method of arriving at credit due to hog feeding operations reflects over a period of years the correct picture.
[2] Represents net price per lb. after all items of expense are deducted.
[3] Includes cost of vaccination, freight and market price.

It is realized that the hog-feeding method of garbage disposal has been held in bad repute in a number of instances. Flint officials feel, however, that this is due, not to the system *per se*, but to the lack of conscientious effort in meeting the requirements that hog-farm management entails. Garbage feeding combines all of the very hard work of farming and includes the rather careful operation that is required on the stock farm. In addition to these requirements it also includes the disagreeable feature of handling "waste food products."

In order to keep the ground sweet lime is applied each year on those areas which are used most for feeding purposes. About one-third of the farm acreage is available for growing farm crops such as rye, oats and corn. Rye is particularly desirable because it provides green pasturage for the quarantine pigs both in the fall and in the spring. Rye fields are pastured to a certain point, after which the animals are kept out of the field and the crop of rye is allowed to mature. The grain is not particularly good for feeding but it can be sold and the straw used for bedding during the fall and winter months. Oats are highly desirable and necessary during the quarantine period. Corn is a good food for animals undergoing hospital treatment.

According to the laws of Michigan the city is not required to pay taxes on the land and personal property at the farm. To maintain friendly relations with township authorities and people in the neighborhood of the farm taxes are paid, the same as though the enterprise were a private corporation engaged in the business. Farmers in the neighborhood are permitted to haul away refuse and manure, which is a valuable fertilizer. In this way good relations are maintained with the authorities and the people living in the immediate vicinity of the farm.

A byproduct of feeding operations is bones collected with garbage. During the period of a year about 100 tons of bones accumulate and are sold for fertilizer purposes. The market price of bones this past year was $13 per ton.

Personnel

The farm is operated by a foreman, who lives at the farm, six laborers and a night watchman. The feeding schedule is such that two men are on duty Sundays. Detail figures in the accompanying table furnish a financial perspective of the accomplishments for the last six years. The writer believes that the net per capita cost of 40c. for the combined services for the fiscal year 1935-36 is a very low figure and reflects the economy resulting from disposing of the city's garbage in the manner outlined.

The division of waste collection and disposal at Flint is one of the major divisions of the Department of Public Works and Utilities and is in direct charge of H. J. Pidd, superintendent.

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Treatment of Timber Increased Last Year

THE VOLUME of timber treated in 1936 was 24 per cent greater than in 1935, according to the regular annual statistical report prepared by R. K. Helphenstine, Jr., of the United States Forest Service, in cooperation with the American Wood-Preservers' Association. The per cent increase for various individual items was considerably above this general increase, but an increase of only a 10 per cent for crossties, which constitute 55 per cent of the total volume, lowered the general percentage. If ties are excluded, the timber treated in 1936 shows an increase of 47 per cent over 1935.

The total volume of timber treated in 1936 was equivalent to 2,669,567,028 f.b.m., compared with 2,153,267,640 f.b.m. in 1935. Structural lumber increased from 284,704,548 f.b.m. in 1935 to 386,112,348 bd.ft. in 1936, a gain of 35.6 per cent. Piles increased from 12,678,607 lin. ft. in 1935 to 19,119,278 lin.ft. in 1936, or 50.8 per cent. Of this amount, 15,357,926 lin.ft. or over 80 per cent, was southern pine. Douglas fir ranked second, with 3,313,562 lin. ft. The remainder was Norway pine, lodgepole pine, oak, and cypress.

Fast Work on Large Shafts

Six-months time limit on East River vehicle tunnel shafts at New York is being met by power shovels for mucking and heavy surface cranes for hoisting

FAST work in excavating the shafts, one of them of unusual size, is marking the start of construction on the Queens Midtown vehicle tunnel under the East River at New York city. The time limit for the larger shaft, which is the one of particular interest because of the methods employed, was six months. With a section about 60x112 ft. and a depth of about 110 ft. this shaft called for 4,400 cu.yd. of earth and 24,000 cu.yd. of solid rock excavation. This need for volume operation was answered by an unusually heavy equipment installation including a power shovel in the shaft for handling the blasted rock.

As shown by the map Fig. 2, the new vehicle tunnel, neglecting the approaches, goes under the East River on a flat skew from about the line of 41st St. in Manhattan to Borden Ave. in Queens Borough on Long Island. The construction plan calls for a ventilating shaft and a construction shaft on each side of the river. The present shaft operations include the ventilating shaft on the Manhattan side and the construction shaft on the Long Island side. This difference in the order of construction was influenced by the ground conditions, which vary greatly on each side of the river.

On the Manhattan side the ventilating shaft is in solid rock and fill and impervious clay from above ground-water level and can be excavated in the open and the twin tunnel headings turned and air locks installed. Inshore also the approach tunnels can be constructed in open air. The logical plan then was to excavate the ventilating shaft, put in a preliminary lining and use it as a construction shaft until the time came to take it over for complete lining and installation of the ventilating equipment. Meanwhile the smaller construction shaft would be constructed, and used for the tunnel work when the ventilating shaft was taken out of construction service. This is the plan being followed.

Ground conditions on the Long Island side are quite different. The logical plan there was to build a smaller construction shaft first and begin shield tunneling from that point. This is the plan being followed.

In order of construction the Queens shaft comes first. The excavation dimensions were about 34¾x90¾ ft. and it was about 67 ft. deep; there was about 2,900 cu.yd. of earth and 4,600 cu.yd. of rock excavation. The shaft structure is shown in diagram by Fig. 3; the placing of 550 tons of steel and 1,530 cu.yd. of concrete being the main construction problem. Essentially the structure is a watertight bottom and shell of steel and concrete, an air deck and a bulkhead below the air deck forming two compartments so that the tunnel tubes can be put under compressed air separately if and when desired.

Fig. 1. A power shovel on the shaft bottom speeds work on the 60x112-ft. rock shaft for the East River midtown vehicle tunnel at New York.

Sheeting and Excavation — Construction was begun Oct. 23, 1936. To take out the 30-ft. depth of earth

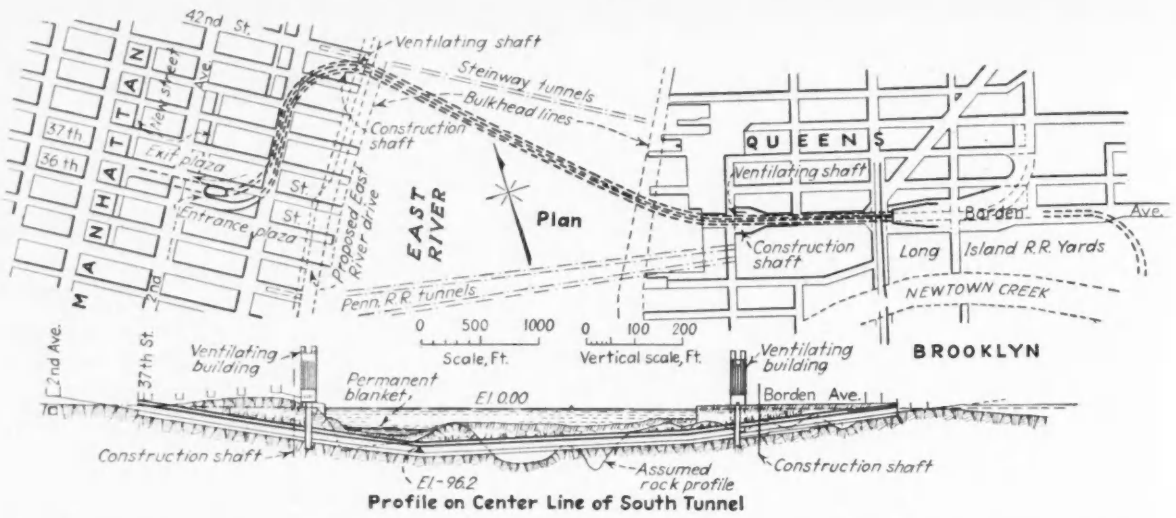


Fig. 2. Twin-tube vehicle tunnel being constructed to connect midtown Manhattan with New York's Long Island boroughs and seashore and sound pleasure resorts.

a double tier sheetpile cofferdam was built. The area was dug down below the level of the second set of bracing; the top two sets of bracing were then assembled in the hole and the sheeting was set up around them and driven below the level of the next set of timbering. This lift was then taken out and the third set of bracing placed.

The wales of the top three sets of bracing were double spaced to pass the sheeting of the lower section. This was now set up and driven to rock; an air hammer handled by one of the cranes and a follower were used. Excavation then proceeded to rock surface, three more sets of bracing being required. No bracing was needed in the rock.

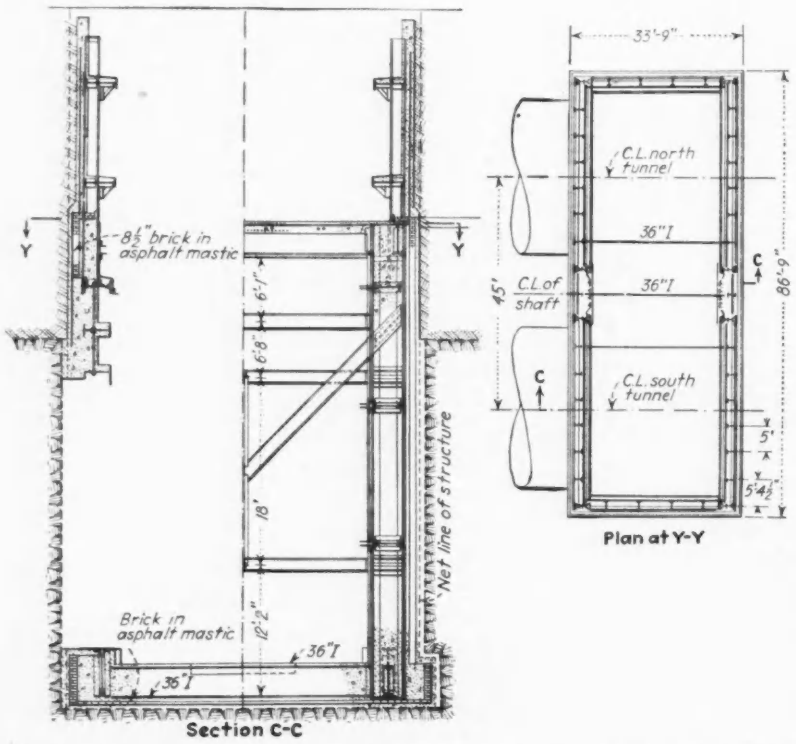


Fig. 3. A heavy steel and concrete shell, bottom, and air deck for the Long Island shaft provides the starting point for compressed air work toward Manhattan.

The earth was excavated with 1-yd. clamshell buckets, handled by a pair of heavy gas crawler cranes that dumped directly into 5-yd. trucks. The first 20-ft. lift of rock was line-drilled just outside the pay planes, using three wagon drills. After this lift was taken out, line drilling was carried down to the bottom just outside the neat lines. Nine hammer drills were employed.

During the rock sinking the steel-erection derrick was put up on the river side of the shaft. Fitted with an 85-ft. boom, this released one of the cranes handling rock skips and 2-yd. scale boxes. These were dumped into trucks.

Steel erection

The upper bracing was designed for the most part not to interfere with steel erection, but the air-deck section, with wide side-plates carrying angle connections for jack-arches, came at the surface of the rock, and there was no way to avoid having to remove the two lowest sets to erect these plates. Many of the sections set weighed 12 and 15 tons, and the derrick boom was shortened to 65 ft. to handle them. They were lowered vertically through the bracing into the clear space below and turned into place. Riveting was finished on April 16, the large number of field rivets (14,000) requiring four riveting gangs.

The most difficult problem was the removal of the two lowest layers of

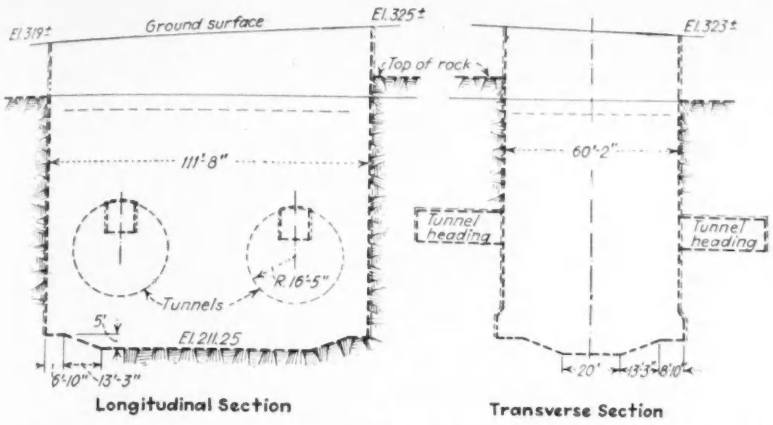


Fig. 4. Large ventilating shaft excavation sections from which compressed air work and shield tunneling will be started in Manhattan.

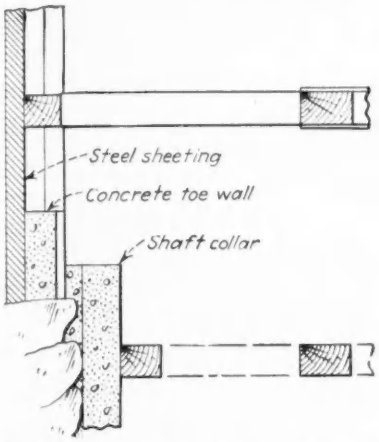


Fig. 5. The bottom of the earth sheeting at the Manhattan shaft was braced by a toe wall at the top of the rock surface.

bracing to erect the steel at the level of the air deck. The columns of the upper portion of the shaft structure were set first inside the waling. These columns are held in the finished structure by two heavy string courses. The eight ends of the long sides of these courses measured 33 ft., and were among the longest pieces set, except for the main 45-ft. column sections. The lower string course had to go in before the lower cofferdam bracing could be removed. To set the long sections they were lowered one at a time into the clear space and turned up endwise through the bracing into position.

In contrast to the heavy lining operations in Queens, shaft construction in Manhattan was almost solely excavation. Fig. 4 shows diagram sections of the shaft excavation, which had to be carried on in an area of about 150x200 ft. available for the contractor's use and on which he must place his plant and store his material.

Sheeting and Bracing—To sustain the possible heavy loads of plant and material during the early stages of tunneling operation the sheeting and bracing of the earth pit, about 16 ft. deep, were designed for a surface loading of 500 lb. per sq.ft. The sheeting was not driven. Instead the contractor took advantage of the dry winter and spring to dig out the entire hole to rock with a power shovel in the open. This made it possible to line drill the top 30 ft. of rock shaft, put in the concrete heel wall (Fig. 5) stand the 18-ft. arch-web sheeting up behind it and bring in the bracing in large, assembled sections.

While the earth excavation was being made with a 1¼-yd. steam shovel and 5-yd. motor trucks, the bracing (Fig. 6) was framed and assembled at the Newtown Creek yard of the Hunters Point Lumber Co. in sections the size of a barge deck. The sections were ferried across the river to 42nd St. where one of the two heavy traveling cranes swung them ashore and the other crane picked them up, one at a time, walked into the lot with them and placed them.

Rock Excavation—Two cranes with 50-ft. booms operated one along each side of the shaft. At first, the five 2-yd. scale boxes and six 2-yd.

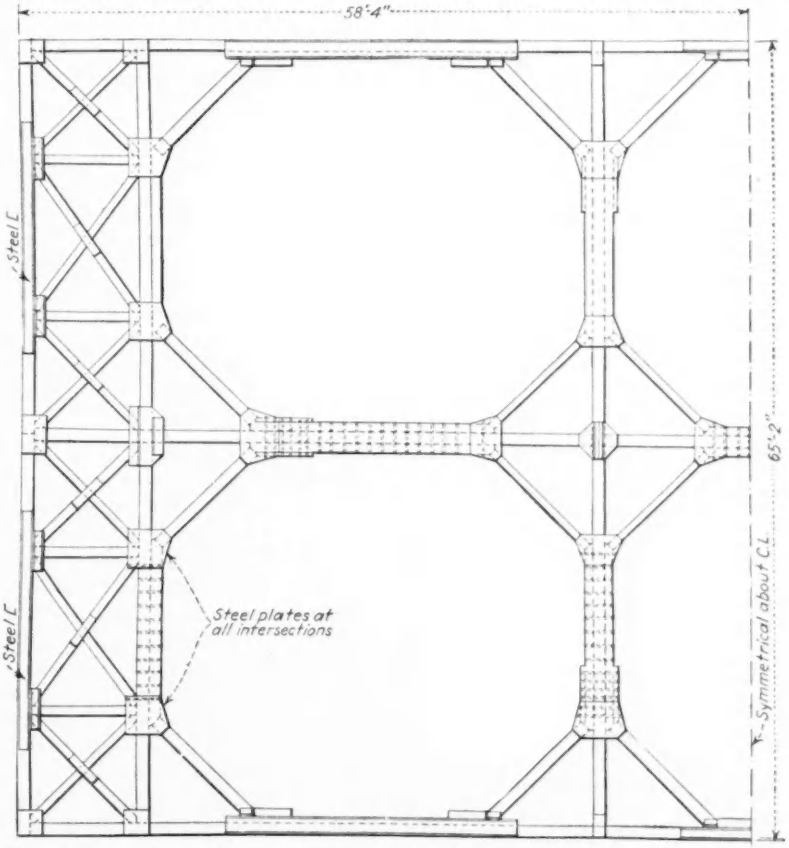


Fig. 6. Very heavy interior bracing of the Manhattan shaft in earth was called for by the assumed ground loads of 500 lb. per sq.ft. This is a half plan of the bracing.

center-dump skips had to be loaded by hand. They were dumped direct into 5-yd. motor trucks. As soon as 18 ft. headroom below the bracing had been secured at one end of the shaft, a small gasoline operated shovel was assembled on the floor to muck out. By the time sinking had progressed about 50 ft. into rock, a larger shovel with a 1¼-yd. dipper replaced the smaller machine.

In addition to the three wagon drills used at the start for line-holing, eight hand drills have been used. They are supplied with air by four 315-ft. gasoline-driven compressors, through a receiver and a 4-in. pipe line. Holes up to 10 ft. in depth are used in sinking, starting each lift in one end and working to the other with a diagonal or V-face.

The job is run with three 6-hr. shifts, six days a week. Blasting is confined to the hours between 7 a.m. and 11 p.m., and not more than 10 holes, or 88 sticks of 40 per cent dynamite, are fired at a time. About four rounds to a shift are averaged under these conditions. In addition to taking out the main shaft, when the level of the top of the tunnels was reached four 10x10-ft. headings were started, each driven in 30 ft.

The rock has been hard and solid for the most part. Practically no water has seeped into the shaft, and the only pump required has been a 2-in. air-driven centrifugal to remove drill water. Enough of the latter has been used to keep the air at the bottom of the shaft free of dust. The cranes carry their own lights for night work, and two large flood lamps are used in the lot. For lighting the floor of the shaft, hanging reflector lamps are let down from the bracing.

For construction purposes, the shaft will be left lined with a thin wall of protective concrete, and will be braced by sets of timbering, the pockets of which will conform with those of the bracing in the top cofferdam. No bracing or shoring of any kind has been required during the sinking.

Directing personnel

The Queens Shaft was built by the G.A.M. Construction Co., Burdette Kipp being chief engineer for the contractors until his death in January, when R. P. Gustin of the firm took charge with Arthur J. Foote as engineer. The Triest Construction Co., has the Manhattan Shaft contract. Work has progressed under the personal direction of Willard G. Triest, president, and John I. Hogan, chief engineer with Richard Byers as superintendent. The Queens Midtown Tunnel is being built under the direction of the New York City Tunnel Authority, consisting of commissioners Alfred B. Jones, chairman, Albert T. Johnston and William H. Friedman, with Ole Singstad as chief engineer. Jacob Mechanic is engineer of construction. The financing of this project is being accomplished by means of a loan and grant from the government through the Public Works Administration. The estimated cost of the entire project is $58,365,000 and the expenditure of this sum is under the supervision of the State Director, PWA, New York.

New England Flood Plans Analyzed

Well-rounded study advocated to determine the maximum possible use of reservoirs proposed for the Connecticut and Merrimack river valleys

INTERSTATE COMPACTS for flood prevention in the Connecticut and Merrimack River valleys have been approved by the legislatures of Connecticut, Massachusetts, Vermont and New Hampshire. New Hampshire and Massachusetts negotiated an agreement relating to the Merrimack River, and all four states participated in one providing for flood control in the Connecticut valley. There remains now only formal approval of these agreements by Congress before they become effective and construction can start. An outline of the Connecticut River compact was published in *Engineering News-Record* April 8, 1937, p. 533; the Merrimack agreement is similar to it.

The interstate agreements relating to the Merrimack and Connecticut rivers were the subject of discussion at a recent meeting in Boston at which Prof. H. K. Barrows of Massachusetts Institute of Technology, regional consultant to the National Resources Committee, pointed out how the agreements follow the recommendations of the Water Resources Committee of the National Resources Committee and compared the latter recommendations with those of the U. S. Engineers for the two river basins. In view of the importance of the interstate compact the following abstract of Professor Barrows' paper is given:

The great flood of March, 1936, with damages of about $75,000,000 in New England, refocussed public attention on flood relief. Previous flood experience had led to much preliminary study by governmental and engineering groups and specialists, followed by some reservoir construction and other improvements in parts of Vermont and New Hampshire. The problem was taken up in a broad way, however, after the 1936 disaster.

The Water Resources Committee found the outstanding water problem in the Connecticut Valley to be the development of a storage reservoir system to serve the needs primarily for power and flood control, and secondarily to insure the low water flow both in quantity and quality, thus helping recreational uses and navigation as well as lessening pollution effects. The 1936 flood resulted in damage of about $35,000,000 in the Connecticut Valley, about 55 per cent of which was in Massachusetts and 33 per cent in Connecticut. The main river produced 85 per cent and tributaries 15 per cent of the damage. This flood was of the order of 300 to 500-year frequency. Including indirect damages, the committee estimated that $15,000,000 to $20,000,000 would be the maximum that could be justifiably expended for flood prevention alone in the Con-

necticut basin. It appears that flood damages will not alone warrant the outlay for storage reservoirs to prevent floods, and the committee held that the solution of the problem lies in the use of reservoirs primarily for power but incidentally providing a byproduct of flood prevention. This assumes intelligent operation under the general supervision of a suitable agency.

The committee recommended 37 reservoirs with 1,120,000 acre-ft. capacity, controlling 53 per cent of the area above Holyoke and costing about $40,000,000. One-half the cost would have to be carried by power values plus the other benefits of increased low-water flow, which in the lower river would rise from about 2,500 to 5,000 sec.-ft.

The present total developed capacity of water power in the basin is about 600,000 hp. in 63 plants which generated about 1.5 billion kw.-hr. in 1932. A study of power increase due to storage shows about 170,000 kw. increased capacity on a 25 per cent load-factor and about 340 million kw.-hr. added output at these plants. The combined benefits from power and flood control thus will justify the cost of $40,000,000. The growth of energy consumption in the four states should absorb a future yearly increase of about 350 million kw.-hr. Preliminary study indicates that some 400,000 hp of capacity is available for comprehensive development in the Connecticut basin, with a yearly output of about 1 billion kw.-hr. A complete plan for the river should include such future power developments, with determination of desirable projects and a program of priorities.

In the Merrimack Valley the problem is similarly comprehensive. From data now available, nine reservoirs with a total capacity of 620,000 acre-ft. controlling about 70 per cent of the area above Franklin, N. H., and 38 per cent of that at Lawrence, Mass., can be built for about $18,000,000, of which 40 per cent would be allocated to flood control and the rest to power and other benefits. Further investigation is in progress. The present developed capacity of water power in the Merrimack basin is about 200,000 hp., and many undeveloped power sites exist and should be investigated fully.

The 1936 flood caused direct damage of about $20,000,000 in this valley, of which $7,000,000 was in New Hampshire and the rest in Massachusetts, principally in Lowell, Lawrence and Haverhill. About 40 per cent of the total damage was to highways and bridges. It appears that an outlay of perhaps $8,000,000 to $10,000,000 for reservoirs is warranted for flood protection alone. As on the Connecticut, the desirable procedure is a combined use of reservoirs primarily for power but incidentally for flood prevention.

The U. S. Engineer Corps plan outlines 20 reservoirs for the Connecticut at a cost of about $35,000,000, and having 644,000 acre-ft. storage capacity. These are to be for flood control. Dike protection is also proposed for Hartford, Springfield and other places on the lower river. The initial plan incorporated in the interstate compact provides for eight reservoirs costing about $13,000,000, and regulating 7 per cent of the area above Holyoke. On the Merrimack five tentative projects costing $17,000,000 are proposed for flood control. An initial plan lists two flood control reservoirs costing $7,000,000 and regulating 25 per cent of the drainage area above Lowell.

Comparison of plans

The plans of the U. S. Engineer Corps for the Connecticut and Merrimack rivers are directed especially to the purposes of flood control and do not adequately take into account the important water uses and aspects of power and recreational use and sanitary benefits due to a well regulated and increased low water flow.

On each river reservoir flood benefits are assumed which are approximately the equivalent of the full direct damage that has occurred in the major flood, this flood being in each case one of extremely rare occurrence.

A comparison on this basis of Miami Conservancy data with figures for the proposed Connecticut River system is of interest:—

		Proposed by U. S. Engineers	
	Miami River	Connecticut River	Merrimack River
Drainage Area	4,000	8,000	4,000
Major flood direct losses	$70,000,000	$35,000,000	$20,000,000
Loss per sq. mile	$17,000	$4,400	$5,000
Cost of control project	$30,000,000	$35,000,000	$17,000,000
Ratio, Cost to major flood losses	0 43	1 00	0 85

The cost of dike protection for the lower cities should be added to the cost of the flood control project on the Connecticut River. This will perhaps add another $10,000,000, making the ratio of total cost to major flood losses for the Connecticut about 1.28. The ratio for the Merrimack River is 0.85.

Again, from the point of view of yearly flood values the estimates of the U. S. Engineer Corps are nearly double those of the Water Resources Committee on both the Connecticut and Merrimack rivers.

These great differences in the fundamental basis for arriving at warranted flood control expenditures are of great importance and should be reconciled, if possible.

The initial plans, especially for the Connecticut River, will only make a start toward the ultimate goal and the future may find it difficult to obtain federal funds to complete these projects. It would therefore appear wise to utilize every means possible toward their financing, and allocate benefits to power, recreation and sanitation, where such benefits will accrue.

In the interstate compact relating to the Connecticut River, definite specifications are incorporated for eleven reservoirs, of which eight are to be included in the initial plan.

To illustrate, the compact provides: "At North Hartland on the Ottauquechee River, controlling a drainage area of about 222 sq. mi. and providing flood-control storage for about 4.1 in. of runoff over said drainage area, the dam at said reservoir to be for flood control only."

It is unfortunate that such definite specifications for reservoirs are fixed in advance of the determination of the complete plan for the Connecticut River. Thus, at the North Hartland site there is an opportunity to develop some 10,000 hp. of power with a head of about 140 ft. at relatively low cost. Moreover, there is some 245 ft. of developed head in use on Connecticut River below that could utilize the stor water. A portion of the cost of this reservoir could well be carried by power uses. As definitely specified in the compact this cannot be done.

In Prof. Barrows judgment, the main reservoir proposed for the Merrimack Basin, viz., at Franklin Falls, is inferior to that selected by the

New Hampshire Water Resources Board at Livermore Falls. Costs of the two are practically the same but the Franklin site will store only 3.1 in. on 1,000 sq. miles or 3,100 "inch-miles," while that at Livermore Falls will store 12 in. on 408 sq. mi. or about 4,900 "inch-miles" of the worst flood-producing area in the basin. This location offers an excellent power site capable of producing 60 million kw.-hr. yearly, nearly all primary, at low cost. It will also give flood protection for the river between Livermore Falls and Franklin, where serious damage has occurred.

This also illustrates the advantages of a relatively high degree of storage development fundamental in flood control, as planned by the Water Resources Committee—up to about 50 per cent of the average yearly runoff in the more complete control of a drainage area, so as to provide for flood control, power, recreation and sanitation aspects, all in harmony.

The method of flood control proposed by the Water Resources Committee, based fundamentally upon the use of power-storage reservoirs, with a relatively high degree of storage capacity, has been in effective use in New England for many years. The regulated portions of the Connecticut River (its upper reaches) and the Deerfield, are controlled by storage reservoirs normally used for power purposes, but found as thus operated to be of high efficiency for flood control.

"We are building for the long-time future—and public clamor for hurried action should not prevent sufficient time being taken to produce a complete plan which can in due season be carried out and which will harmonize with the full and best economic development of these two river basins, which include a generous portion of New England," said Prof. Barrows in closing.

"The present situation in respect to flood control is not peculiar to New England. The recent floods on the Ohio and Mississippi have caused renewed demands for action. This should be met, especially by the engineering profession, with the insistence that sufficient time be taken to plan thoroughly, wisely and soundly from an economic view. Hurried action, without complete and adequate planning, would be most unfortunate, both financially and because of probable disillusionment as to results."

Disinfection of New Water Mains

Chance contamination may pollute water unless effective sterilization is employed.

DISINFECTION of new and repaired water mains before they are placed in service is an essential precaution to be observed in order to avoid the possibility of disease transmission. Merely flushing pipe lines is not sufficient to remove chance contamination, and experience has indicated that unsterilized mains may remain contaminated for three to twelve months.

The importance of water main disinfection was stressed in a paper by Roy M. Harris, chief, division of public health engineering of the Washington state department of health, presented at a meeting of the Pacific Northwest Section of the A.W.W.A. on May 20-22. Mr. Harris cited a recent case of contamination which occurred when new mains were laid in the town of Port Orchard, Wash. The mains were not disinfected and in a short time after they were placed in service samples of water showed the presence of coli-aerogenes organisms. Hypochlorite solution was added immediately to the water and later a chlorinator was set up. The contamination continued to manifest itself for 98 days after the first attempt was made at disinfection. No illness occurred because residents were warned to boil all water.

Field investigations disclosed that the contamination had occurred during construction when a mechanical trencher had cut through sewer lines which drained into the pipe ditch.

Reviewing other possible causes of main contamination, Mr. Harris listed the following:

(1) Contamination of pipe in factory or in shipment;

(2) Contaminated hemp or jute used for packing;

(3) Voiding of urine or excrement into trench or pipe by careless workmen;

(4) Trench dug in contaminated soil.

In addition, there is always the unavoidable foreign matter that enters a pipe during construction, and the ever-present possibility that some of the workmen are typhoid or dysentery carriers. In the discussion of the paper by C. M. Evarts, Jr., acting state sanitary engineer, Oregon board of health, it was stated that two other possible causes of contamination were the use of untreated water for testing purposes, and the trapping of small animals in the main during construction, which are subsequently drowned. It was suggested that all new mains over 4-in. diameter should be disinfected.

Mr. Harris stated that the Washington state board of health requires that all new wells and pipe lines shall be disinfected in an approved manner and thoroughly flushed before being placed in operation. To accomplish this the department issues recommendations giving a choice of disinfection either by the use of chlorine-containing compounds or by portable chlorine sterilizers. A table accompanies these recommendations in which quantities of high test hypochlorite sufficient to give 50 p.p.m. chlorine for each size of 20-ft. length of pipe are given. Although these regulations were in effect when the Port Orchard installation was made, through some oversight this project was never submitted to or approved by the state department of health and therefore the usual provisions calling for disinfection of mains was not made a part of the specifications.

THE NEW GERMAN EXPRESS ROADS SEPARATE OPPOSING TRAFFIC STREAMS AND PROVIDE LONG SIGHT DISTANCES

Impressions of German Express Roads

by PAUL WOOTON

Washington Correspondent, Engineering News-Record, Washington, D. C.

Touring the new German state highways and talk with their builders disclose a trend in highway thinking that offers much of interest to Americans

IN GERMANY all visiting engineers go to see the express roads, so that in visiting the Leipzig fair this spring the writer took special pains to ride over a part of the new national road system and to confer with the officials who are directing and executing these remarkable superhighways. He found himself in a large company.

So great is the interest in this highway building program that special arrangements have been necessary for handling the engineers and other visitors who call at the office of the Inspector General of Roads in Berlin. The office records show that practically every country in the world has sent technical advisers to Germany to acquaint themselves with this development. There is outstanding interest in observing what can be accomplished when a far-flung highway program can go forward without any decentralization of control and without delays incident to the acquisition of rights-of-way and under conditions where influence on the selection of route may be disregarded if it hampers the attainment of broad objectives.

Officials in the Inspector General's office are convinced that their experiment will give a great impetus to the construction of separate roadways for through traffic, into which local traffic is fed directionally at infrequent intervals, with cross traffic carried over or under the through express road.

Naturally the German conception has a definite application to conditions that exist in European countries. In Germany not only are roads narrow and crooked but the custom of driving herds of live stock over the highways is a common one; there is a large amount of horse-drawn traffic; there are sections where the ox cart is in general use, and with the improvement of surfacing during recent years has come a great upturn in the use of bicycles. Operation of passenger automobiles on such roads obviously is highly unsatisfactory. Even when new roads are built to bypass the abrupt turns and the congestion of villages and towns, experience has shown that the new road immediately becomes a preferred site for industrial plants and residences and in a short time is almost as congested as is the route through the heart of the town.

What is now Germany formerly was a group of independent states that had no connecting system of roads. Establishment of the empire in 1871 did not change the situation greatly. Roadbuilding was left almost entirely to local authorities. They concentrated their efforts upon maintaining existing roads which for the most part followed the haphazard courses dictated by the needs of other centuries. Thus, prior to the World War little had been done in the eighteen German states to fashion roads for automobile use. After the war rather extensive highway improvements were undertaken in the areas immediately tributary to cities. Then came the emergency which led to the concentration of authority in the national government. One of the incidents of this change was to remove the obstacles to the planning and construction of major highways on a national basis.

A picture of the area served by the German express-road program may be had by comparison with a similar area in the United States. A system

of through highways serving the following American cities would cover a territory of somewhat similar extent: Detroit, Toledo, Cincinnati, Richmond, Va., Washington, Baltimore, Philadelphia, New York, Boston, Buffalo and Pittsburgh. In Germany the key points are Hamburg, Bremen, Hanover, Essen, Cologne, Frankfort, Karlsruhe, Stuttgart, Munich, Nuremburg, Dresden, Breslau, Beuthen, Berlin, Stettin and Koenigsberg.

Population in the German area is nearly double that of the American area delineated above. There is need in Germany for supplementing railroad transportation in a major way; while the railroads themselves are operated in a highly efficient manner, not so much may be said for the handling of goods through terminals and the effecting of deliveries. The railroad-operated motor truck service, which is making large use of the *autobahn*, is reducing the time period between the point of pickup and the point of final delivery.

While Germany was prompted to undertake its ambitious superhighway program largely as a means of providing employment, that was not the only reason actuating this policy. Roads suited for automobile use were recognized as essential to the stimulation of that industry. It was found that the automobile industry would produce more value per person than any other large industry, and what is more, it would provide customers for another great domestic industry—that of making motor fuel from coal. All of this meant that the express roads would make possible much indirect employment. With one-third of the system in use the results have exceeded expectations: The output of the automobile industry has doubled in less than two years and motor car registrations have increased from 661,800 in 1934 to 945,000 in 1936.

There is another very important reason for undertaking to criss-cross Germany with roads at an admitted average cost of 500,000 marks per kilometer. This added reason is that only domestic materials are used. No precious foreign exchange need be employed. The whole operation is carried on with marks. With a managed currency there is plenty of domestic money. There is no need for dollars, francs or pounds. No foreign loans need be floated. The money is supplied by domestic borrowing. The German people readily buy the bonds of their government. Even were the cost to be 2,000,000 marks per kilometer ($800,000 per mile) as some claim, Germany probably could justify the project for the reasons mentioned.

Germans take unusual pride in efficiency. It was almost a matter of chagrin to them that they were behind many countries in motor transport. Life was moving at 60 mi. an hour but traffic on most of their roads was at the rate of 5 mi. an hour. This conflicted with German ideas of efficiency.

Equipment industry developed

The highway program has greatly stimulated the cement and road machinery industries. One-eighth of the cement production of the country is being absorbed for highway use.

While very heavy machinery is used in building the express roads work is proceeding also on the old highways of various types. That system comprises 212,000 km. There is a strong demand for all sorts of mechanical equipment. As it is more practical to overpass the narrower local roads the express roads run mostly through cuts. Heavy excavating machinery has been employed. Narrow-gage track parallels the work. Industrial locomotives and dump cars are used.

All of this has greatly stimulated the highway machinery industry. The industry had pretentious exhibits at the spring fair in Leipzig. Diesel engines are used almost entirely in a wide range of sizes. Pneumatic tires are employed on a surprisingly large proportion of the equipment. Tire treads of artificial rubber are being used. While synthetic rubber costs more than the natural product its resistance to abrasion makes its use practical on tires to be put to particularly hard use.

The exhibits showed a strong tendency toward welding in the manufacture of machinery. Provision for minimizing oiling is being made by enclosing gears and by use of anti-friction bearings. Portable crushing and screening plants are made in a multitude of sizes. Demonstrations of rock drills and pavement breakers constituted one of the features of the fair. Many improvements in this type of equipment were claimed, greatly reducing the need for blasting. Improvement is claimed on vibratory motors. Vibrators permit the use of coarser aggregates.

Tractor track said to have a much longer life than that heretofore used was on exhibit. Improvements in transmission permit greater speed on some of the motorized equipment. Dirtmoving machinery, small and large, was much in evidence, as were compressors and pumps in wide variety. As Germany is particularly proud of its chemical products considerable space was devoted to wood preservatives and a variety of tars. Much was claimed for chemicals that accelerate the setting of concrete.

Thus the effect of the highway building program is seen far beyond the limits of the new roads themselves.

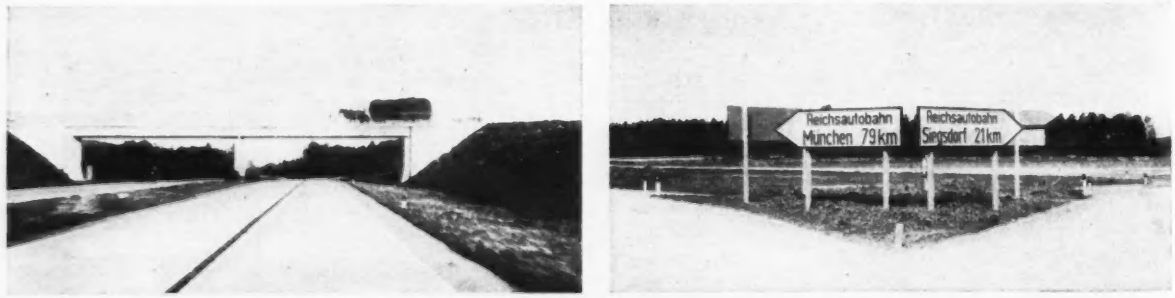


Fig. 2. Crossing safety is secured by separation of grades, and large directional and warning signs give vision at a safe distance

FIG. 1. STEEL TIED ARCH AT RUMFORD, ME., READY TO BE MOVED ENDWISE ONTO NEW PIERS.

Bridgebuilding Down East

by WALDO G. BOWMAN
Associate Editor, Engineering News-Record

In the valleys of the Merrimack and the swift rivers of Maine flood-damaged structures are being replaced and repaired in wholesale manner

THE FLOOD OF MARCH, 1936, whose trail of damage was followed up the Connecticut River in last week's issue, also left its indelible marks in the valley of the Merrimack and along the streams of Maine. In transferring sightseeing operations to these "down east" streams, the bridge-wise traveler continues to find interesting and instructive examples of repair and reconstruction on every hand.

Small bridge damage in New Hampshire was particularly severe, and a trip up the Contoocook, a Merrimack subsidiary, furnishes much enlightenment on this class of structures. Old stone spandrel-filled arches will be found in ruins or they may be standing in spite of hell and high water. A few of them show hardly a trace of damage, a result, it will be learned, of building a reinforced concrete arch inside of the old bridge without disturbing any of the original stones. On one such bridge, of two 50-ft. spans, the water was 10 ft. higher on the upstream than on the downstream side and still the structure was not damaged.

On this same stream, a 40-ft. concrete barrel-type rigid frame will be encountered that settled 18 in. at one end and was jacked back into position without damage of any kind. Similar new rigid frames up to 70 ft. span will be found replacing the old stone arches that were lost. And just off the Contoocook at Hancock, on a little sub-tributary, plans are under way to replace an old covered timber bridge of hallowed memory with a modern covered timber bridge, using steel dowel connectors instead of wooden pegs or iron bolts at the joints and a truss type whose stresses are determinable in contrast to those in the multiple-intersection trusses of our forefathers. The bridge will cost as much as a steel or concrete bridge, but it is worth even more to the New Hampshire people who live near it.

On the Merrimack itself, a through-truss span in the four-span bridge at Hooksett is the first evidence of flood damage encountered. This bridge crosses the river several hundred feet downstream from stone piers that starkly protrude from the water as a reminder of the old covered timber railroad bridge which floated down to wreck the highway span. Then, at Manchester, the flood continued its destruction. Aided by two 15,000-gal. oil tanks, the high water knocked three old 130-ft. lenticular truss spans at Bridge St. from their piers, bringing the city face to face with a job deferred for too long, namely replacement of this low-level and light structure with a modern high-level crossing. The new bridge, now under way, will when completed be one of the largest in New England. The river span, a 420-ft. spandrel-braced arch, is in itself longer than the old bridge, and in addition there are long approaches of concrete arches that bring the total length of the bridge to 2350 ft.

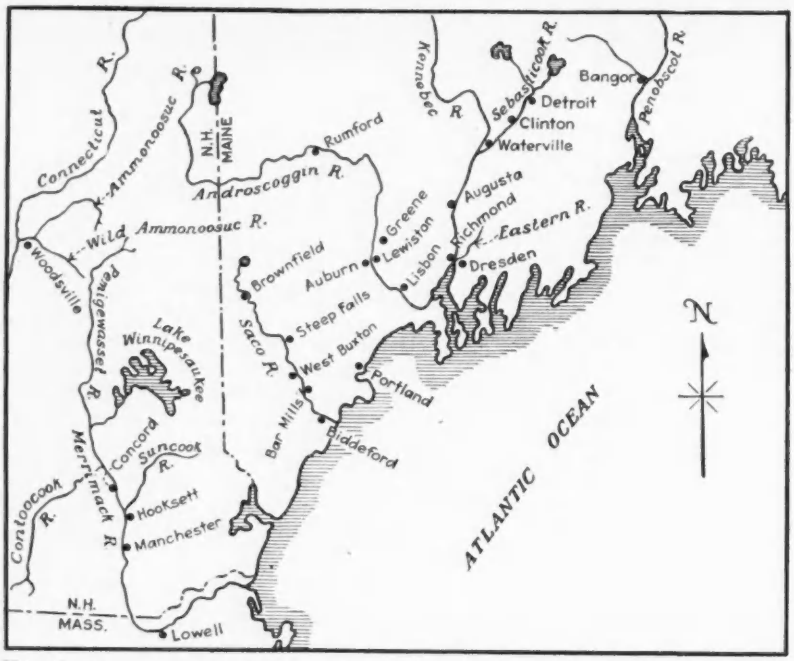


Fig. 2. Sites of principal bridges damaged by floods on the Merrimack and the rivers of Maine.

Whereas the old bridgeheads were at the river bank, the east abutment of the new bridge, for example, is on a high hill, and between it and the river are two canals, a railroad and a group of mill buildings, all of which are spanned. While the new bridge is under construction a temporary timber suspension bridge of 430-ft. span provides a pedestrian river crossing. This is the structure that utilizes four 1½-in. diameter cables from the old Brattleboro suspension bridge. Framed with dowel connectors, the bridge is a modern example of timber bridge construction. It cost $13,000.

The next step southward is in Massachusetts where, at Lowell, the Merrimack damaged two bridges, requiring some lower-chord replacement on one (at Moody St.) and hastening the abandonment of the other (known as the Central Bridge) in favor of a new bridge whose construction will soon begin. At Moody St. a curve in the river just above the bridge site directed the flood current against the south bank, the granite-faced wall of a power canal, from which it rebounded against the bridge. The four eyebars of the upstream lower chord of this deck truss structure were bent and squeezed together to such an extent that the chord will be largely replaced, using adjustable eyebars installed one at a time in each panel. The granite-faced foundations of this bridge were not only undamaged but exhibit no marks from the ice and debris which struck them. Above and below this bridge site, for a length of nearly 1000 ft., the Army Engineers are straightening the river by blasting out large quantities of rock, so that the flow conditions of the last flood will not be repeated.

The current item of interest at the Central Bridge (Fig. 3) is a timber suspension bridge for the use of pedestrians after the highway bridge is torn down to make way for the new crossing. The footbridge has a span of 473 ft. Each main span cable consists of four 1½-in. diameter wire ropes which continue over the rocker towers to the anchorages. In the backstays these four ropes are supplemented by an additional rope. A horizontal tie cable joins the tops of the two towers. The bridge is similar to the one at Manchester, but because new wire rope was used for the cables and an expensive pier had to be built under the north tower it cost more, $35,000.

The new highway bridge will be a through-cantilever structure with 197 ft. main span (including a 113-ft. suspended section) and 138-ft. anchor arms, carrying a 40-ft. roadway. The existing old abutments will be widened and used, but new river piers will be constructed.

Maine's swift rivers

Next in line for inspection is Maine with its four swift-running rivers—the Saco, Androscoggin, Kennebec and Penobscot. Although 17 major crossings of these streams went out and are being replaced, both the manner of failure and the type of new construction lacks, in general, the individuality apparent in the New Hampshire and Massachusetts structures.

Practically all of the bridges were old and of light steel truss type. Ice

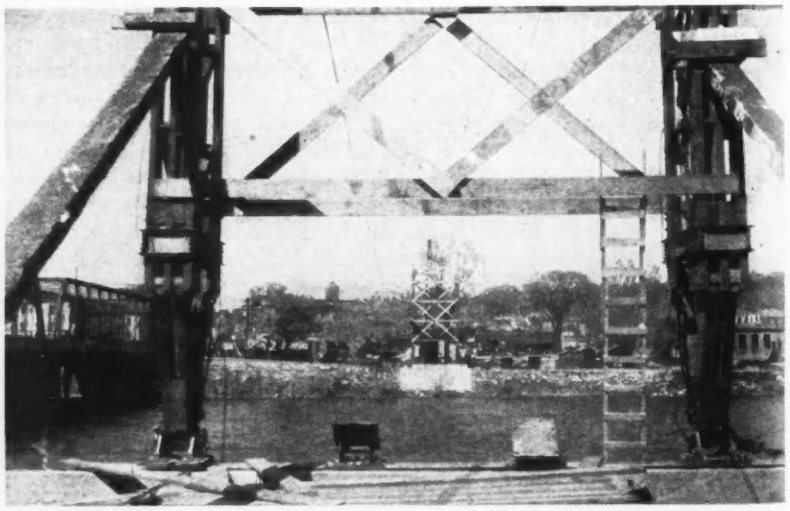


Fig. 3. When this pedestrian suspension bridge with timber towers is completed at Lowell, Mass., the old Central Bridge at the left will be replaced by a 197-ft. span cantilever.

carried on the crest of the flood knocked them off their piers or caused scour that resulted in pier settlement and ultimate superstructure collapse. The replacement operations are interesting but not sensational. Perhaps the most notable characteristic of the new crop of Maine bridges is the use of several continuous designs. Under the circumstances, brief references to the bridges that would be encountered on a trip up and down the river valleys will provide sufficient detail on Maine's "flood" bridge program.

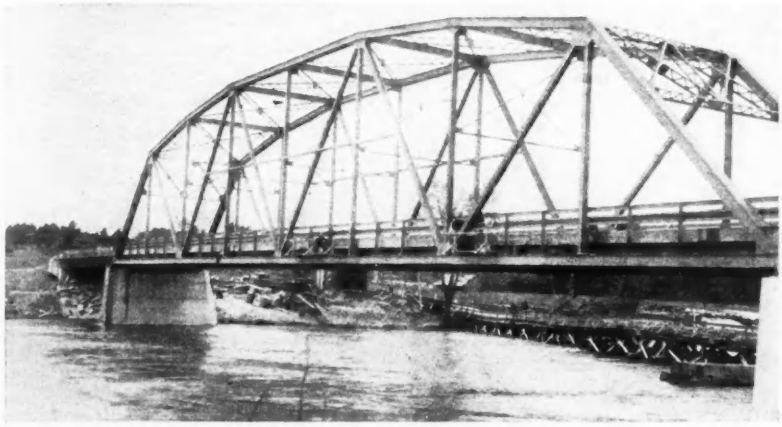


Fig. 4. New span over Saco River near Biddeford, Me., is typical of Maine improvements although smaller than some. Old bridge, one of whose stone piers is shown at the right, was not much higher above water than temporary trestle.

Starting up the Saco, the city of Biddeford is the scene of two new bridging operations. In the city itself new foundations are complete for a bridge of continuous rolled girder spans (57½-75-75-75-57½ ft.) to replace three old steel truss spans and four beam spans. This new bridge is the only one in the program that is being built below the 1936 flood level, a result of the high cost of approaches that would otherwise have been necessary. The continuous design, heavy lateral bracing and a reinforced concrete deck are counted upon to give the structure the strength and rigidity to resist floods that may overtop it. The second bridge, a mile or two out of town, is a 225-ft. through truss flanked by 75-ft. rolled beam spans at either end. (Fig 4). It replaces three old steel trusses, two of which were washed off of the piers. The new bridge, slightly downstream from the old, greatly improves the roadway alignment. This bridge will be completed in July.

At Bar Mills, a major highway improvement is resulting from the flood damage—a much longer bridge is being built on the line of the approach roads on either side, eliminating sharp curves at one end of the old bridge. The new bridge will consist of a three-span continuous truss (140-224-140 ft.) plus a 139-ft. simple truss span over a power canal. While the bridge is under construction traffic is accommodated by a series of half-through timber truss spans on the alignment of the old steel trusses that were washed out. The old stone foundations supplemented by rock-filled timber cribs constitute the piers of the temporary timber bridge (Fig. 5).

Next upstream is West Buxton, where evidence of the flood battering is still to be seen. The old bridge, consisting of a series of steel trusses, was located directly below a power dam of overflow type and of reasonably modern construction. However, an emergency spillway proved entirely inadequate for the huge volume of water, and an earth embankment behind the west abutment washed out, practically draining the reservoir and cutting a channel for itself through the bridge approach fill. Foundation construction is under way for a new bridge on the old alignment, which will consist of a three-span continuous truss (146-234-146 ft.) considerably longer than the original bridge. The power company has replaced the washed-out embankment of its reservoir with a huge rock-filled timber crib and will construct an enlarged emergency spillway in this section to drain into the channel cut by the flood.

Although this new bridge improves the river-crossing facilities at this point, it has been placed on the old alignment, which at the east end requires right-angle turns onto the main highway. Consideration was given to a relocation of the bridge on an alignment above the dam, but local residents opposed the idea so strenuously that it was dropped.

The other bridges on the Saco are at Steep Falls, where a 220-ft. through span on a raised grade is being built to replace an original bridge consisting of a 150-ft. steel truss and an old timber truss, and at Brownfield, where a two-span covered timber bridge is being replaced by a 200-ft. truss and two 65-ft. beam spans.

Moving a 230-ft. arch

From Brownfield the trip northward brings the traveler to the upper reaches of the Androscoggin and the town of Rumford, where Maine's most sensational flood damage and flood reconstruction has occurred. Rumford, like Turners Falls in Massachusetts, is located in a sharp bend of the river and is served by several bridges. Only one of these, a high modern concrete arch structure, escaped flood damage. As Bion F. Jose, town manager, said, "We are a town of bridges and as such we have certainly had our troubles." These troubles include the near loss of a four-months old 230-ft. tied steel arch, the washing out of an old and abandoned steel truss railroad bridge, and the loss of a steel truss footbridge and a steel truss highway bridge.

Like the steel arch above Bellows Falls, that at Rumford had a miraculous escape. Known as the Morse bridge, this bridge was begun in 1934 to replace an old 180-ft. steel truss that was badly damaged in the 1927 flood which at this point had a peak discharge of 50,000 sec-ft. The new bridge being 50-ft. longer than the old, a new abutment was built on the west, but on the east bank the abutment of the old bridge was utilized. This bridge, built to pass a peak discharge of 60,000 sec.-ft., was opened to traffic in November, 1935. Four months later the March, 1936, flood pushed 74,000 sec.-ft. past the bridge and in doing so fell just short of completely washing out the old abutment upon which its east end rested. The

Fig. 5. Temporary timber truss bridge at Bar Mills, Me. Rock-filled cribs supplement old bridge piers as supports.

actual result was that one corner of the bridge on this abutment dropped about a foot. A major repair job obviously was necessary, and a new abutment required.

The novel expedient adopted was to build new abutments 50 ft. east of the existing abutments, and then to move the 1000-ton span lengthwise onto its new supports (Fig. 1). A beam span was then installed between the west abutment and a new pier on the river bank, increasing the discharge capacity at the bridge to 100,000 sec.-ft. The old east abutment was torn out and the river bank upon which it rested was removed. The new east abutment was incorporated in a long retaining wall built by the WPA. Moving the bridge span, which will be described in more detail in a later issue, was complicated by the fact that the bridge was on a grade, with the east end 2 ft. below the west.

Fig. 6. What ice did to one of the unreinforced concrete piers of the Kennebec River bridge at Richmond, Me.

Next down the river is the site where the old bridge of the discontinued railroad line went out, and below this a three-span through-truss footbridge on the same piers with a highway bridge. Although the footbridge, being the upstream unit, took the brunt of the punishment from water, ice and driftwood, only its center span went out while all three spans of the highway bridge collapsed. Since the tops of the stone piers on which the highway bridge rested also disappeared in the flood waters, this fact probably accounts for the failure of the highway bridge whereas the two end spans of the footbridge and their supports remained intact. The WPA has rebuilt the steel span of the footbridge and raised the entire structure 2 ft. by adding concrete caps to the tops of the piers and abutments. Work is just starting on a new highway bridge on a new alignment. The new structure will consist of a 278-ft. truss span over the river with a 70-ft. beam approach span on the Rumford side and a 60-ft. beam span on the opposite side.

For a considerable stretch of the river below Rumford no damage was done, but in the vicinity of Lewiston destruction is again encountered. At Turner, about five miles north of Lewiston, a four-span steel truss bridge went out and is being replaced by two 228-ft. spans on a new center pier and raised abutments, and at Lisbon about 10 miles below Lewiston three old steel trusses which went out are being replaced by a two-span (168-112 ft.) continuous truss and a flared beam approach span.

The cost of the Maine bridges referred to so far has varied from about $100,000 to $140,000 each. At Lewiston the most expensive bridge in the program is under way. Consisting of three 235-ft. through truss spans on two new piers, this crossing between Lewiston and Auburn will cost $350,000. A considerable part of the high cost is in the foundations, which required the driving of a large number of piles. The old bridge, about 700 ft. long, consisted of seven pin-connected trusses about 40 years old. Scour under the third pier from the Lewiston shore spilled two of the old pony truss spans into the river. Since a modern new bridge was badly needed no attempt was made at repair.

Ice wrecks a modern bridge

Although the most expensive new bridge in Maine is at Lewiston on the Androscoggin, the greatest bridge loss occurred 20 miles to the east on the Kennebec at Richmond where a modern five-year old bridge was the victim of a record-breaking ice pack. Consisting of five 200-ft. spans, the bridge lost three spans, including a swing span, when the ice moved sideways under the bridge, tipping over or literally breaking the concrete piers in two. This ice, 25 or 30 ft. thick, was practically irresistible and the piers being unreinforced and exposed to great pressure in their weak direction failed. In addition to the three piers which actually went out, the piers under the two spans that remained in place were badly cracked. (Fig 6). It is planned to salvage what is possible and rebuild the bridge, using some of

the old steel. But even with this salvage, the reconstruction job will cost $205,000.

Another interesting failure occurred at Waterville, upstream on the Kennebec, where a bridge of four deck trusses built in 1880 went out when a stone pier failed dropping two spans into the river. This bridge adjoins an abandoned reinforced concrete arch bridge built in more recent times for street railway traffic. The reconstruction plan provides for extending the street railway bridge piers upstream to support a new continuous deck girder bridge. Its span lengths, 133-96-145-143, are unusual because they correspond to the existing pier locations. The old concrete arch bridge will be utilized as a sidewalk for the new bridge but the time is foreseen when it may be replaced by another line of girders to give a completely new and modern structure.

At the other Maine towns shown on the map, new steel truss bridges varying from 90 ft. to 260 ft. are under construction. All replace light steel trusses except the Dresden bridge, which occupies the site of an old sliding timber draw span, and the Bangor bridge which replaces a three-span covered wood truss structure.

Missouri River Blocked at Fort Peck

by Capt. C. H. Chorpening
U. S. Engineer Department, Fort Peck, Mont.

Unexpected slide threatens vital railroad bridge and nearly wrecks carefully-planned diversion procedure, but rapid shifting of closure to downstream toe successfully turns the river and avoids a possible year's delay in construction of big earth fill

In a brief but spectacular culmination of nearly four years of planning and effort the Missouri River at Fort Peck Dam in Montana was diverted on June 24 from its old channel into four concrete-lined tunnels through the shale bluffs at the east side of the valley. Diversion was effected by closure of the center opening of the dam, through which the river has flowed for the past three years while placement of the fill has proceeded on both sides of the stream. Carefully-made plans for closure of the dam at the upstream toe on June 26 were suddenly changed by an unexpected slide of the river bank at the downstream toe which threatened the loss of the railroad bridge at that point. Closure was successfully made under emergency conditions two days ahead of the planned date with operations shifted to the downstream location.

To understand the diversion and closure operations it is necessary to review the general construction features and the preparatory activities leading up to the climax of the actual stream diversion.

Fort Peck Dam is being built of earth—100,000,000 cu. yd. of it—with a length of nearly four miles, of which the 9,000-ft. main section lies in the valley proper and the remainder is a dike section on a bench to the west. The main section has a base width of nearly 3,000 ft. and a maximum height of 242 ft. Placement of earth is by the full hydraulic process, the material being pumped from valley-bottom borrowpits by

Fig. 1. Plugging the Missouri River at Fort Peck Dam was accomplished in a hurry by dumping rock and gravel from the railroad bridge at the downstream toe as a slide threatened to wreck the structure. This view, looking upstream, shows the gravel cars being dumped, a fleet of bulldozers pushing gravel into the stream from each side and a derrick boat building up a rock sill to hold the gravel in place. The slide area is at the left end of the bridge.

four 28-in. electric suction dredges.

Four tunnels of the size and length required to conduct the river around the dam (nearly 25 ft. in diameter and over 6,000 ft. long) could not be designed and driven in advance of the start of filling without delaying that work for nearly three years. Hence the army engineers commenced pumping of the fill in October, 1934, building the dam in two sections, one on each side of the river, leaving an 800-ft. opening for the stream until such time as the tunnels would be ready. When work started on the tunnels in May, 1934, the schedule called for their completion in time for diversion in 1937. Although the problems of construction were difficult and at times the prospects of meeting the time schedule looked bleak, all obstacles were overcome and the tunnels were ready to receive the river at 1:00 a. m., on June 24, 1937. The only item remaining of the tunnel job is the installation of the main control gates which will be done in 1938. In the meantime, each tunnel is provided with two tractor-type emergency gates.

Practically all of the dredging prior to closure was from the upstream borrowpits. The reason for this procedure is obvious; dredges left upstream after closure would be landlocked and, further, would be unable to reach suitable material. During the past winter downstream pipeline trestles were constructed so that the only work remaining at the time of closure, as far as the pipelines were concerned, was the actual transfer of the pipes from their old positions to their new downstream areas.

The inlet portals of the tunnels are about one mile from the river and the outlet portals about half that distance. Channels had to be cut at both places to points from where, in a comparatively short time, the remaining "plugs" could be removed. A considerable portion of the inlet channel was cut away by dredging in 1935 and was used as a harbor for the entire dredging fleet during the past two winters. Dryland excavation methods, using shovels and trucks, were employed at both portals to remove any material containing shale, for the dredges cannot cut the shale.

Another preparatory task for the closure was the building of a railroad trestle across the 800-ft. closure section at the upstream toe. This trestle was framed and erected during the past winter and spring.

Up to the time of closure effluent water from the corepools was discharged back to the river over cascade spillways, one on each side of the river. After closure such a procedure could no longer be followed, and some other provision had to be arranged to handle the water. It was finally decided that the most economical method of disposing of the waste water was to use pumps mounted on barges. Four pump barges were constructed, each provided with one electrically-operated centrifugal pump identical with those in use on the dredges.

Final preparations

In the closure section of the dam the clay and vegetable matter had to be stripped from the underlying sand as it had also been removed from the base of the dam already covered with fill. Some of this stripping was done by draglines during the past winter and the remainder was performed by the pump barges. An ingenious arrangement of lashing two pump boats together, the use of improvised swing lines, and reducing the discharge from 28 in. to 15 in., thus forming a giant double monitor, proved to be the most efficacious in sluicing off the overburden of clay and vegetation. The sluiced material was carried away by the river current. Only a few isolated corners could not be reached and in those instances machine and hand methods of removal were employed.

With the exception of the pump boat stripping, all of the above preparatory operations were carried out well ahead of the earliest possible date for closure. Plans for the dredge moves, pipeline dismantling and relaying, dumping of rock and gravel to effect the actual closure, cutting of the inlet and outlet plugs, and the other incidental tasks immediately associated with the closure, were worked out on a *D* day basis. To explain: *D* day, or closure day, having been established, then on *D* minus 10, or the tenth day prior to closure, dredge Gallatin was to commence cutting the outlet plug and other operations were to start at appropriate and exactly scheduled dates to fit into the systematic scheme.

In addition, many other advance arrangements had to be made. For example, the Great Northern R.R. was asked to bring in 300 general service cars from Duluth for handling gravel shipments and 120 air-dump cars from many points to handle the glacial boulders. Early measures were taken to insure that the gravel plants at Cole, Mont., were ready to operate at full capacity. The rock-loading facilities at the boulder stock piles were carefully checked.

The selection of *D* day was dependent on two prime factors; the date when the tunnels would be ready, and the time when all danger of spring high water had definitely passed. On June 15 the district engineer designated June 26 as *D* day and men and machines went into action at once.

Dredge Missouri was promptly set into the inlet channel and in two days reduced the plug to a 50-ft. top width, wasting the material into an adjacent coulee. This work having been completed, the dredge was moved downstream, her floating and land boosters having previously been towed down to their new positions.

On June 16, dredge Gallatin was moved to the outlet channel and commenced biting into the 500-ft. plug of earth separating the tunnel portals from the river.

As rapidly as possible the other two dredging units, Jefferson and Madison, were towed to their downstream berths. Meantime, pipeline crews were dismantling the old upstream lines, trucks were thundering over the roads conveying the heavy 12½-ft. sections of pipe to the new positions on the trestles previously built. On June 22, dredge Missouri commenced pumping from her downstream pit, discharging into the upstream position of the closure section.

The pump boats were moved into their places, two on each side of the closure section upstream of the steel sheet piling cutoff wall. Pipelines for the discharge of the dredge effluent by the pump boats were laid up the closure slopes and thence upstream of the upper toe. Snagging of the river throughout the closure section was thoroughly performed and a final cleanup made of all vegetation, drift and debris. As much gravel was dumped into both upstream and downstream toes as prudence allowed without unduly or dangerously con-

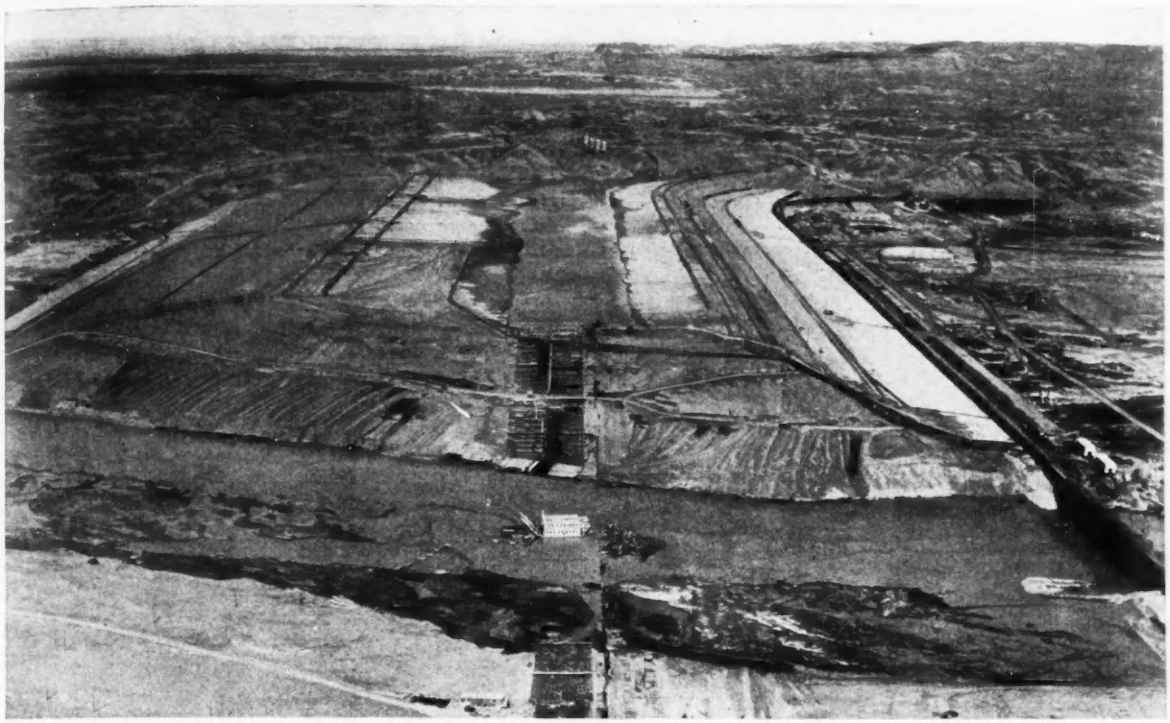


Fig. 2. Fort Peck Dam about ready for diversion. This view, looking east, shows the east section of the fill with the river in the foreground, in which two pump boats are sluicing the loose material from the valley floor. To the extreme right is the upstream toe trestle from which closure was to be made but an emergency necessitated closing the river gap at the downstream toe, just out of view to the left. The four towers beyond the core pool are gate control houses over the diversion tunnels. The dark streak at the upper right is the tunnel inlet portal structure.

stricting the channel. Lower portions of the cascade spillways were removed so that they would be in the clear for placing the closure fill. Raising of the cutoff wall by welding sheets to those previously set across the closure gap proceeded rapidly; design requires these sheets to project at least 20 ft. into the core. Timber booms to catch driftwood were fabricated and placed across the river in the inlet channel, one at the river entrance and one at the tunnel inlets.

At both inlet and outlet channels a low clay levee had been built between the natural plugs and the tunnel openings. These levees provided an additional safety factor and permitted the placing of water counterweights against the head of the river water behind the plugs. At the inlet plug the top elevation was cut first to El. 2,050, then to 2,047, then to 2,044, as *D* day drew near. The river meantime hovered near El. 2,037.

Slide changes plans

As stated above, closure day had been set for June 26th. But, at 3:00 p. m., June 23, a slide of the fill occurred, caused by the rapid fall of the river after the annual June rise, in the right section of the dam immediately adjacent to the east concrete pier of the Missouri River bridge. This earth movement threw a tremendous load against the pier, pushing it out of line and opening up a large crack, endangering the main bridge span. It was at once appreciated that further earth movement might take place at anytime with the grave possibility of losing the bridge. Should this occur, closure could not be made for some some, possibly having to be postponed until 1938. Also, the bridge is a vital artery for the supply of material to the spillway and for the remaining tunnel work. Accordingly, it was decided to divert and close on the 24th. Due to the necessity of holding the slide and of strengthening the bridge, an immediate radical modification in closure plans was necessary. It was decided to make the closure at the downstream toe.

Rock and gravel were promptly dumped around the threatened pier and along the toe of the slide. The small amount of work remaining on the diversion tunnels was rushed to completion, the tubes being ready to receive the river at 1:00 a. m. on June 24. Draglines and bulldozers went into action at both inlet and outlet plugs. Bottleneck of the operation was the outlet, where nearly 200 ft. still separated the dredge from the previous excavation. But with five draglines and four bulldozers working smoothly, an opening was quickly made and orders were given to blow the retaining levee at the inlet at 4:20 a. m., June 24. The natural plug at the inlet had been opened two hours before, allowing the water to come up against the levee. At 7:25 a. m., water commenced flowing through the outlet channel and by 2:00 p. m. the flow through the tunnels was 2,400 sec-ft., or about one-fourth of the flow of the river.

Over 400 carloads of rock and gravel were available and plans were carefully worked out to secure the maximum possible speed in dumping. To assist in blocking the river a derrickboat, equipped with a 3-yd. orangepeel, which had been used to place rock around the weakened pier, was spotted just downstream from the bridge. To push gravel and rock

into the opening, a fleet of thirteen bulldozers was assembled, on both sides of the channel. Preliminary to starting actual closure 45 carloads of rock (20 to 2,000-lb. blocks) and sixteen carloads of gravel were dumped at the sides of the span.

At 4:51 p. m. closure commenced. Trains of gravel were in cuts of 40 cars each and the operation was so timed that, as soon as one train was unloaded another rolled onto the bridge immediately. While the gravel was coming from above, the derrick-boat below was picking rock from the abutment and placing a downstream sill which aided greatly in holding the gravel in place against the swift current. The bulldozers were effective in pushing rock and gravel from the sides. At 7:05 p. m., the Missouri River channel was entirely dammed and the river was flowing entirely through the four diversion tunnels. A total of 140 carloads of gravel, over 5,600 cu. yds., had been dumped in 2 hr. and 14 min., or at a rate of more than a car per minute.

Dredging had been stopped during the actual closure period, but was started promptly after the stream was blocked. Fill commenced to pour into the closure section at 9:40 p. m., June 24. Dumping of gravel will continue at a daily rate of 200 or more cars until both upstream and downstream toes are up to full height in the closure section.

The river gage prior to closure stood at El. 2,036. After the channel was closed and the entire flow diverted through the tunnels, the pool rose rapidly to El. 2,046. Flow of the river at that time was 9,600 sec.-ft.

All operations are proceeding satisfactorily and nothing is foreseen at this time which will prevent orderly and steady progress on the placing of the fill in the closure section of the dam.

Today the Missouri at Fort Peck finds itself in strange and new surroundings, forced by engineering skill to traverse concrete and steel-lined tunnels. Throughout the stretch from Fort Peck to the head of the reservoir (180 river miles) the turbulent and restless river can no longer change its course at will; nor can it flow below the dam at other than the rate allowed by the men at Fort Peck. The Missouri has been effectively bent to the will of man!

Notes on Sewage Disposal

A monthly summary of current developments conducted by Willem Rudolfs

MILK WASTE TREATMENT — Treatment of crude milk waste by the activated sludge process has been reported from time to time and emphasis has been placed upon the necessity to dilute crude milk washings with purified effluents or water. Jenkins (*The Surveyor*, Mar. 26, 1937) reports that after eighteen months continuous operation of a large scale plant it was found unnecessary to dilute; as a matter of fact better effluents were obtained by the aeration of strong crude liquids for a longer period than by the treatment of weaker liquids for a correspondingly short time. A reduction in B.O.D. from 350 to 5.8 p.p.m. was obtained after 24 hr. continuous aeration, storage and settling.

SAND FILTERS SEWAGE—Sewage containing large quantities of trade wastes, which is almost impossible to treat on trickling filters or by the activated sludge process, can be purified to some extent by rapid sand filtration. The possibility of settling and filtering sewage-waste mixtures to make the effluent amenable for biological treatment is described by Mahr, (*Annual Report*, 1936, Wupperverband). He reports large-scale operations with sand filters 30 in. deep, supported by triangular concrete blocks. The sand, with a diameter of ½ mm., allows a filter rate of 6 ft. per hr. and produces a total suspended solids removal of 60 per cent as compared with 35 per cent obtained by sedimentation alone. The effluent of the filter, containing the balance of the putrescible substances, can then be handled by biological means.

BULKING SLUDGE—Sludge bulking in the Nagpur, India activated sludge plant is cured by speeding up the return of reactivated sludge (*The Surveyor*, 439, 1937). The sludge in the final settling tanks, which occasionally becomes full of filamentous growths and rises, is brought back into condition in a few hours through this procedure, which is said to produce electrochemical changes. Reference is made to the water in India, where material in suspension which normally would not settle in six months is readily coagulated with chemicals; it has been found that all particles carry positive charges of electricity. Under these conditions activated sludge acts as an efficient coagulant.

METAL WASTES RECOVERY—The treatment of poisonous chemical wastes containing copper, zinc and chromium discharged from the pickling of metals should include the recovery of byproducts in the sludge produced to make the method practical and economical. Kimball, Steiner and Wadhams (*Biennial Report* Conn. State Water Comm. 1936) describe the operation of a pilot plant treating 100 gal. per hr. of acid waste liquor from brass and copper industries. The process developed for wastes when no chromium is present consists of the use of dilute waste liquor, brass turnings or chips, lime or soda ash and ordinary salt in conjunction with settling tanks and filters. This yields as a byproduct a copper-coated brass suitable for return to brass smelting furnaces and a crude zinc oxide which might be used for the manufacture of zinc salts. It is estimated that the cost of construction, including buildings and equipment necessary to deposit dissolved copper on brass chips and to vacuum dewater the sludge resulting from the precipitation of the remaining metals, would be $148,000 for a plant designed to treat 3 m.g.d.; operating costs are estimated at $35,000 a year. The revenue from recovered copper would be about $3,500 per year.

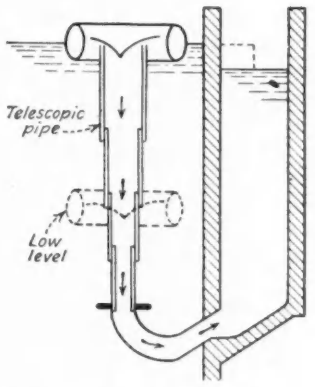
TAPERED AERATION—Gradually more information becomes available to explain why tapered aeration in an aeration tank of the activated sludge process is of advantage when

no highly nitrified effluents are required. In a study by Basiakina (*Report* U.S.S.R. Academy for Mun. Sci., 1936) on the oxygen balance in an aeration tank it is shown that near the inlet of the tank the B.O.D. reduction of the sewage is greater than that of the mixed liquor, indicating that the oxidizable substances present in the sewage are absorbed by the floc. Farther along in the tank, while the B.O.D. undergoes but slight changes, an intensive process of oxidation continues. This continued process is the oxidation of absorbed substances resulting in regeneration of the sludge. Efficient results can be obtained only when practically all of the substances absorbed in the floc have been oxidized and the sludge restored to its original activity. If this is not accomplished, either through insufficient aeration or overloading, the sludge deteriorates and decreased purification occurs. At the same time the rate of organic matter oxidation decreases when the process of purification continues. It is evident therefore, that the intensity of aeration should vary while the sewage passes through the tank. The rate of air reduction would naturally depend upon the degree of oxidation of sewage impurities. If it is correct, as indicated by the author, that the concentration of the B.O.D. of the sewage in the aeration tank corresponds to a definite B.O.D. of the sludge, a simple mathematical formula may be arrived at as a guide for regulating the quantities of air required under different operating conditions throughout the aeration unit.

FERTILIZER PRODUCTION — Digestion materially reduces the fertilizing value of sewage sludge. Even when fresh solids are dewatered many dried soluble substances as well as a part of the volatile materials useful in plant growth are lost. Stock (*Rundschau Technischer Arbeit*, 16, No. 50, 1936) claims further that the sludge bacteria which are necessary for effective plant growth are killed by the drying of fresh solids. Considerable time must then pass before such sludge on land again becomes active under influence of the soil bacteria. The application of fresh, wet sludge to the soil for fertilizing purposes does not help much either because proper mixing of soil and sludge cannot take place. Besides, a wet sludge blanket prevents free passage of air and decomposition activities are retarded in general.

To overcome these difficulties it has been found advantageous to mix 1 to 1.3 cu.ft. of peat with 1.2 cu.ft. of fresh solids. This produces a friable, easily-spread material and the slightly acid peat is neutralized by the sludge. Pulverized peat becomes coated with sludge and this permits the sludge bacteria to work actively at best advantage. When the mixture is piled in heaps, heat develops and a humus-like fertilizer containing the desirable soluble substances in sewage is obtained. This fertilizer production process has been in operation for some time at Stuttgart, Germany.

WEIR REGULATOR—Overflow and entrance weirs in clarifiers are generally fixed in position or adjustable only by resetting. The water level in the tanks is determined so that heavy stormwater flows will not be backed up into the sewers. In cases where the sewage is pumped, the higher level which is maintained in the tank to take care of relatively few days of high flows results in greater pumping costs. An ingenious method of varying weir height automatically is described by Blunk (*Gesundheits-Ingenieur*, Feb. 13, 1937). (See drawing.) Movable telescopic inlet pipes floating on the surface of the water and located at short intervals around the periphery of the tank are used to vary the inlet height in relation to the flow of sewage. These inlet pipes can be installed either in circular, square or rectangular tanks. The telescopic pipes are attached to floats which permit expansion of the pipe length in accordance with the flow.



Inlet pipe on a clarifier which automatically adjusts itself to flow variations.

TANK DETENTION — American practice in sedimentation tank design is based on a detention period of not less than two hours. Sperry (*Annual Report* Aurora San. Dist. 1936) found that settling periods much beyond one hour for primary treatment did not increase the percentage removal of settleable solids sufficiently to warrant the cost of operating clarifier mechanisms. Besides, there were decided advantages in obtaining a fresher sewage effluent with the shorter detention period. His conclusions were based on operating experiences covering two 6-month periods. The results show that no advantage was gained by the longer settling period:

	Raw Sewage Sus. Sol. p.p.m.	Per Cent Removal	Hours Detention
Jan.-May	138	57.8	2.0
June-Dec.	157	59.3	1.3

SLAUGHTERHOUSE WASTES — Treatment of slaughterhouse waste by trickling filters or activated sludge has been found practicable provided the rate of filtration is low or the time of aeration is long. Partial treatment of this waste by chemicals prior to oxidation has been practiced for a number of years. Experiments made during the early part of 1937 at a bacon factory (*Report* West Riding of Yorkshire Rivers Board, April 1934-37) where the waste waters are pretreated with alumino-ferric precipitant and then passed through settling tanks, trickling filters and final settling tanks, show that repeated filtering of the settling tank effluent produces very good results. The waste, after being passed through the purification plant during the working hours of the day, is stored in a special receiving tank and filtered a second time during the night. This second treatment produces a much higher degree of purification and no doubt a third filtration would produce a stabilized effluent comparable to the best sewage effluent. The process is essentially the same as the Jenks bio-filtration scheme (ENR May 21, 1936 p. 721) in which sewage is repeatedly passing through a relatively small volume of biologic filtering medium in contrast to the usual method of trickling sewage through a larger volume of medium only once. Since the waste at the majority of factories is generally produced during the day time, the system seems to have possibilities of wider application.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

Bridge Design Data Charted

by WALLACE E. BELCHER
Philadelphia, Pa.

In bridge design under the 1935 specifications of the American Railway Engineering Association, a number of graphical solutions for several of the new formulas were worked out by a group of senior students in the engineering school of the University of Mexico. The charts, prepared by Augustin Llabo, Gonzales Salas, Lesus Malo and Solomon Gerson, are reproduced here, and will be found useful for general reference when designing railway bridges.

The diagram for impact coefficients is based upon paragraph 206 of the A.R.E.A. specifications. The factor for lurching effect and the factor for direct vertical effect are plotted separately, and are to be added to obtain the impact coefficient which is to be applied to the maximum computed static live-load stresses. In the formula for lurching effect, S is the spacing in feet between centers of longitudinal girders, stringers or trusses; or the length, in feet, of floorbeams or transverse girders. In the formula for direct vertical effect L is the length, in feet, center to center of supports for stringers, longitudinal girders and trusses (cords and main members); or it is the length of floorbeams or transverse girders, in fact, for floorbeams, floor beam hangers, subdiagonals of trusses, transverse girders and supports for transverse girders.

In the chart for determining stiffener spacing on plate girders, the formula is taken from paragraph 433 of the specifications. The chart for allowable unit stress in compression is taken from paragraph 301.

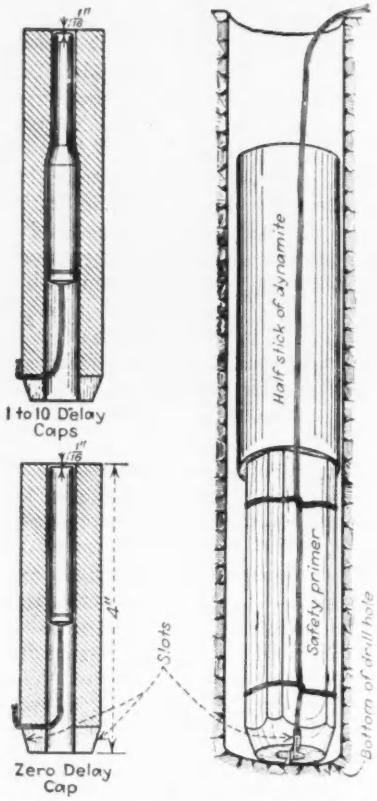
• • •

Use of Safety Primers In Tunneling

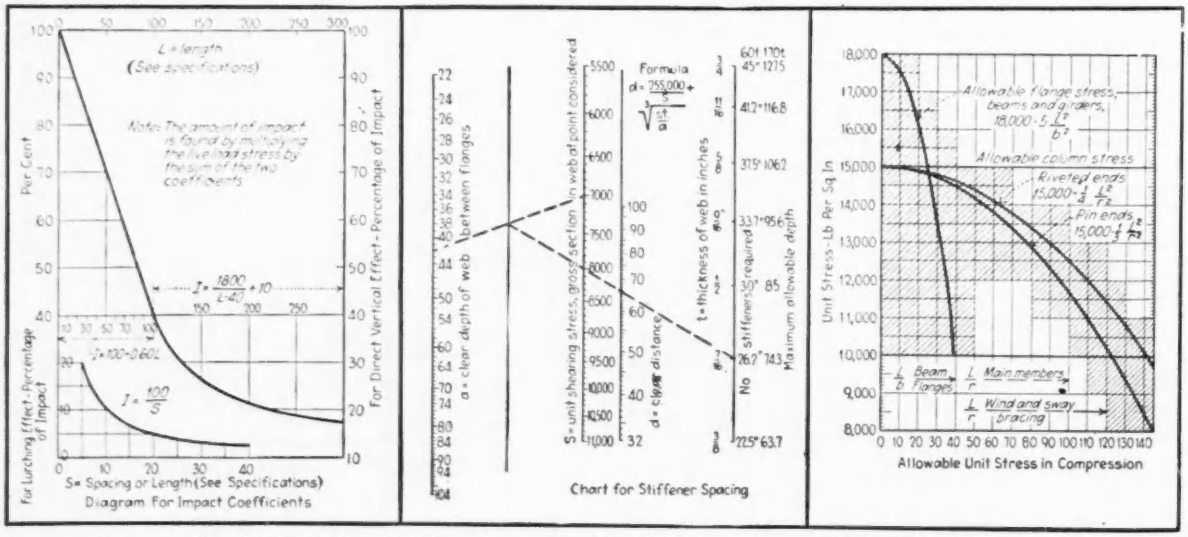
by R. E. MUNN
Assistant Safety Engineer, Metropolitan Water District, Los Angeles, Calif.

Extensive use of safety primers on the Colorado aqueduct tunnels for the water supply of Los Angeles, Calif., has established a procedure suitable for general adoption. Defined briefly, a safety primer consists of an electric blasting cap inserted and glued into a longitudinal hole in a wood plug. The accompanying drawings indicate the arrangement.

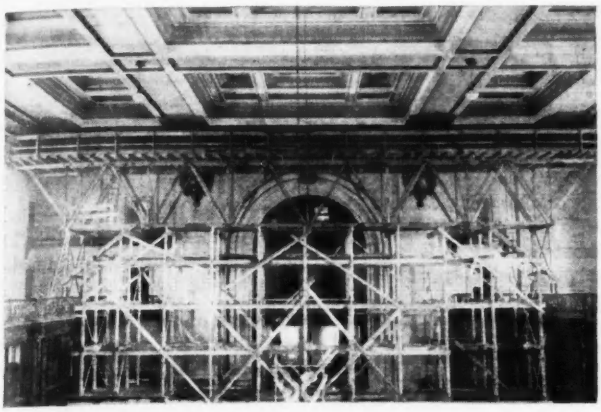
Construction of the primer is simple but exact: The tested cap with the cap wires short-circuited as usual, is dipped ¾ in. at the explosive end in glue and inserted in the plug from its beveled end to exactly 1/16 in. from the square end. After the glue has hardened and fixed the cap in place the wires are half hitched around the plug as shown and the ends secured. This finishes the primer. After testing the hole for clearance, a half stick of dynamite cut square across is pressed against

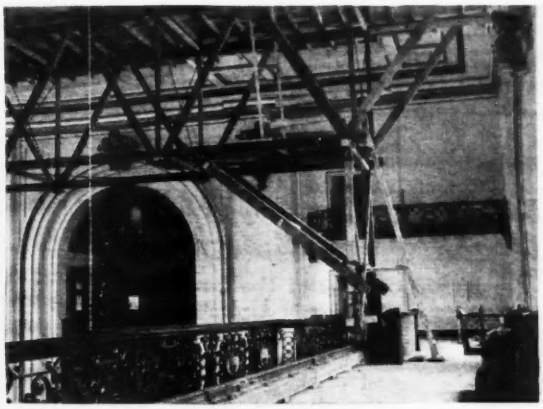


Safety primers made up and loaded as shown were extensively used in the Colorado aqueduct tunneling.


L = length (See specifications)
Note: The amount of impact is found by multiplying the live load stress by the sum of the two coefficients
Per Cent
For Lurching Effect-Percentage of Impact
For Direct Vertical Effect-Percentage of Impact
S= Spacing or Length (See Specifications)
Diagram For Impact Coefficients
Formula
Chart for Stiffener Spacing
Allowable flange stress, beams and girders,
Allowable column stress
Riveted ends
Pin ends
Main members
Wind and sway bracing
Unit Stress-Lb Per Sq In
Allowable Unit Stress in Compression

Graphical solutions for formula contained in A.R.E.A. bridge specifications for 1935.





A gantry scaffold for ceiling painters kept the Albany waiting room and galleries practically unobstructed for regular railway passenger traffic operations over a three weeks' period.

the square end and the assembly is pushed to the bottom of the hole with the loading stick; firm pressure forces the dynamite into contact with the primer. The remainder of the hole is loaded in the usual manner.

Ordinarily a 40 per cent dynamite is used next the primer but in some cases where deep rounds (12 to 13 ft.) are drilled in hard formations, it is advantageous to place a half stick of 60 per cent dynamite in the bottom of the hole, followed by the safety primer, and another half stick of 60 per cent primer powder.

The freshly-cut end of the half stick must be pressed against the explosive end of the primer; this results in a temporary bond between the primer and dynamite, which is maintained until the primer bottoms the hole.

A half stick was adopted for priming after considerable experimentation; the dynamite is 12 in. long, which gives two 6 in. sticks for this purpose. The use of whole sticks would necessitate uncrimping the wrapper at one end to get contact between primer and raw dynamite. This can be done, but the other method is more convenient. The use of whole sticks without uncrimping or otherwise exposing the raw powder to direct contact with the primer, is not recommended as the paper crimping may, under certain conditions, reduce the efficiency of detonation and deaden the effect of the blast.

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A Gantry Scaffold For Painters

By Leon Lieberman
Delmar, N. Y.

To permit the high ceiling of the waiting room of the New York Central R.R. station at Albany, N. Y., to be painted without interfering with its use by passengers, excellent use was made of a gantry scaffold that traveled the length of the room on tracks laid on the side galleries. As shown by the illustration a light staging was set up at one end of the room on which the gantry bridge and legs were erected, blocked up for clearance. The tracks, each a single timber carrying a railway rail, were laid on the gallery floors just inside the railings. The gantry trusses carried a light deck floor on which the painters worked. Access to the deck was by ladders from the gallery floors.

* * *

Brief Memoranda

Pockets on the backs of form panels obviate carrying by hand nails, bolts, hair-pin anchors, tie rods and other supplies for forms at Grand Coulee dam. As the panels are raised to form a new lift the necessary hardware is carried with them. A pocket is provided for each kind of hardware.—Daniel McFarland, Mason City, Wash.

* * *

Bells in 4-in. used boiler tubes to fit them for reuse as vertical drain pipes were formed by a mandrel and pile hammer at Grand Coulee dam. The pile-driver was hung by an air hoist and tackle from an overhead frame; the pipe was stood on end underneath the hammer, the bell mandrill was inserted and a few blows of the hammer shaped the bell. —Daniel McFarland, Mason City, Wash.

* * *

Trailer coaches, specially designed with upper and lower berths, are being adopted by the Ohio state highway department for living quarters of road construction crews. The trailers are towed to the site of construction and parked there much as the old time house cars were parked.

* * *

Hard hats that protect the heads of workers constructing the Grand Coulee Dam are colored to show the kind of work done by the worker. For example, hats worn by inspectors have a bronze color with the initial I in front; surveyors also wear bronze hats but the front is marked with the red and white target of a surveyor's rod. Steel workers' hats have black crowns and a white top.

* * *

Condensation is eliminated by special floor construction for the new Continental Can Co. factory at Tampa, Fla. In the can warehouse and tinplate storage area, where moisture would work serious damage, a 3-in. layer of concrete was first placed and then overlaid with two-ply waterproofing, which was in turn covered by 7 in. of heavily-reinforced concrete flooring. Experiments have demonstrated the effectiveness of this intermediate layer of waterproof material in combating condensation, which has been a source of serious difficulty in plants throughout the South.—The Austin Co., Cleveland, Ohio.

THE WEEK'S EVENTS

(Continued from page 127)

Buffalo Chamber Opposes New Great Lakes Agency

The Buffalo Chamber of Commerce has expressed opposition to a plan in the Norris Bill, now in the United States Senate, which, it is declared, would take control of navigation on the Great Lakes from the U. S. Army Corps of Engineers. The Buffalo chamber maintains that government agencies now in charge of development of the Great Lakes navigation have done a satisfactory job and that there is no need of an authority similar to TVA on the Great Lakes.

• • •

Eagle Mountain Tunnel Work Completed

Completion of all tunnels on the main section of the Colorado River aqueduct, with the exception of the San Jacinto, near Banning, was announced July 1 when workmen placed the last concrete in the lining of the Eagle Mountain tunnel on the aqueduct. Located north of Desert Center, and approximately 200 miles east of Los Angeles, this tunnel is one of 28, totaling 108 miles in length, that form part of the 392-mile metropolitan aqueduct.

Progress reports on July 1 indicated that 104 miles of the tunnels have now been excavated, and 95 miles of these have been lined with concrete and completed. The four miles remaining to be excavated lie in the 13-mile San Jacinto tunnel, considered the most difficult job on the aqueduct. It is expected that aqueduct water will be flowing through it by a year.

• • •

Third Set of Panama Locks To Be Designed

Design of new Panama Canal locks which will handle the largest ships afloat will be prepared by a special engineering section established by Col. C. S. Ridley, Governor of the Panama Canal Zone.

Col. Glenn E. Edgerton, engineer of maintenance, will supervise the work of the section, which will be in charge of designing engineer E. S. Randolph, who occupied a similar post in connection with the construction of the Madden dam. This work was authorized by a resolution of Congress, May 1, 1936.

The cost is estimated at $150,000,000. Work on the plan probably will take ten years, and another ten years would be devoted to construction. The proposed new locks would not be in operation before 1960.

• • •

Triborough Bridge Use Passes Estimate

In its first 50 weeks of operation the Triborough Bridge has been used by 9,500,000 automobiles, as against the estimate of 9,000,000 cars for the first complete year of service. The bridge was opened July 11, 1936.

According to a report submitted to Harold L. Ickes, PWA Administrator, truck traffic over the bridge increases nearly every week. The estimate of 9,000,000 was made by PWA engineers in 1933.

• • •

Henry H. Jeffcott Dies, British Engineer

Henry H. Jeffcott, for 15 years secretary of the British Institution of Civil Engineers, died recently at Walton-on-Thames, near London, at the age of 60. Dr. Jeffcott was born in Donegal, Ireland, in 1877, and was educated at Trinity College, Dublin, gaining high academic honors in the engineering school of the college. From 1902 to 1905 he was in mechanical engineering and testing work, becoming head of the metrology department of the National Physical Laboratory in 1905. In 1910 he was appointed professor of engineering in the Royal College of Science for Ireland, Dublin, holding this post until 1922, when he was appointed secretary of the Institution of Civil Engineers.

• • •

Champlain Span Opens

The new $800,000 bridge across Lake Champlain from Rouses Point, N. Y., to Alburg, Vt., opened July 16. This bridge is owned and operated by the Lake Champlain Bridge Commission, a public authority established jointly by the New York and Vermont legislatures.

BRIEF NEWS

ERECTION of an $86,000 bridge across the Illinois Central Railroad tracks at Fulton, Ky. has been started. It will replace one erected in 1918.

MISSISSIPPI state highway commission at Jackson will award contracts July 27 on 11 projects, costing about $1,500,000, and including 49 miles of paving.

FUTURE MAPS of the state of Oregon will have the "Old Oregon Trail" designated on them. Several years ago the name was eliminated from maps to save space. Historic societies led the move which resulted in the highway commission agreeing to put the name back on.

MEMPHIS, TENN., Engineers Club will award a scholarship to some high school student in the Memphis area who in the opinion of the club promises to become a successful all-round scholar in engineering. The scholarship, worth $450 for the first year, is to enable the student chosen to attend Worcester Polytechnic Institute, Worcester, Mass.

PERSONAL

RUPERT F. BORCHERS is county sanitary engineer for Clark County, Ohio, succeeding Joseph P. Reinheimer.

D. G. KILBURN has been appointed chief engineer of the Board of Railway Commissioners for Canada.

DONALD ELSON has been appointed resident engineer of Union county in Ohio.

MARTIN J. DALTON succeeds John A. Johnston as district highway engineer at Worcester, Mass.

JOHN A. JOHNSTON is now an associate civil engineer in the Massachusetts department of public works.

CHARLES H. MARSH is now assistant chief inspector in the Sixth Ave. section of the Hudson-Manhattan Railway Co.

WILLIAM G. BURNS has become district highway engineer at Greenfield, Mass.

DOUGLAS PLATT of Leadville, Colo., is filling the position as director of WPA in Colorado Springs.

JAMES LOGAN, acting New Jersey state highway engineer, has been made state highway engineer.

ROBERT W. ANGUS of the University of Toronto, recently received honorary membership in the Engineering In-

stitute of Canada at the semi-centennial meeting in Montreal.

BENJAMIN W. LESEUER is assistant bridge engineer for the Maryland state road commission in Baltimore.

ALVIN A. RHOMBERG, county engineer at Dubuque, Iowa, for 9 years, was elected city manager of that city, effective July 15.

Capt. R. E. COUGHLIN, Huntington, W. Va., has been assigned to take charge of the Dover area of the Muskingum watershed conservancy district.

W. P. NEAR, formerly city engineer of London, Ont., has been appointed a commissioner of the Ontario Municipal Board.

A. G. MILLER is in charge of structural and plate fabrication in the Marion Machinery & Foundry Co., Scottdale, Pa.

MEDERIC AUDET of Chicoutimi, Que., has been made divisional chief for that division by the Provincial Department of Roads.

JOHN C. BISSETT, of Dallas, formerly regional engineer for Arkansas and Tennessee, has assumed his duties as city engineer for Corpus Christi, Texas.

HIRAM D. PHILLIPS has been promoted from the post of district engineer to that of associate civil engineer in the Massachusetts department of public works.

WILLIAM H. TRINKAUS, acting chief engineer of the sanitary district of Chicago for the last two years, has been made chief engineer of the sanitary district.

LEE H. JOHNSON, Jr., 28-year-old junior engineer connected with the U. S. Engineer Department, has been appointed dean of the engineering school at the University of Mississippi.

SAMUEL J. HUNGERFORD, chairman and president of the Canadian National Railways, received the honorary degree of doctor of mechanical engineering from the University of Vermont recently.

G. B. SHOUSE, formerly assistant district engineer of the state highway department of Kentucky, was named district engineer for the Ninth District, Somerset, filling the vacancy caused by the death of Guy Byars. (ENR, July 15, p. 119.)

CHAD F. CALHOUN, formerly chief engineer for MacDonald & Kahn, Ltd., of San Francisco, one of the Six Companies engaged in the construction of Boulder Dam, has left the service of that company and has formed the Calhoun Company, with headquarters at Los Angeles.

WILLIAM P. FEELEY, who has been associated with the Great Lakes Dredge & Dock Co., in river and harbor development in Buffalo for nearly 30 years, has been appointed chief engineer of the company with headquarters in Chicago.

CHARLES H. PURCELL, chief engineer, California Highway Commission, was recently presented a citation by the California safety council for carrying through the construction of the San Francisco-Oakland Bay bridge completed last year.

HORACE L. SEYMOUR, civil engineer of Ottawa, Ont., and town planning consultant for the Dominion Government, has delivered a series of addresses in the St. John, N. B., district, aimed at promoting a better public comprehension of proposed zoning by-laws.

CALENDAR OF MEETINGS

NORTH CAROLINA SOCIETY OF ENGINEERS, annual convention, Wrightsville Beach, N.C., Aug. 13-14.

AMERICAN ASSOCIATION OF WATER WELL DRILLERS, annual convention, Hotel Pennsylvania, New York, Aug. 24-26.

AMERICAN WATER WORKS ASSOCIATION, Central States Section, Dearborn, Mich., August 18-20; North Carolina Section, Wilmington, N. C., August 26-28; Rocky Mountain Section, Santa Fe, N. M., September 20-22.

NEW ENGLAND WATER WORKS ASSOCIATION, annual convention, Poland Spring, Me., September 21-24.

AMERICAN PUBLIC WORKS ASSOCIATION, annual conference, Atlanta, Biltmore Hotel, October 4, 5, 6.

OFFICERS ELECTED

ED L. MULVANEY, Jackson, was elected president of the Mississippi Association of Architects at Gulfport, July 10.

H. C. CROWDEN, chemist of the city water works filtration plant, Portsmouth, Ohio, has been elected president of the Portsmouth Society of Professional Engineers.

PROVIDENCE ENGINEERING SOCIETY has elected Alton L. Chick president. Mr. Chick is engineer of the Manufacturers & Mutual Fire Insurance Co., Providence.

OBITUARY

JOHN L. ROBERTSON, SR., Baltimore paving contractor, died July 11 at the age of 69.

TOWNSEND L. HUFF, 68, of the firm of Boyd & Huff, Baltimore, died there July 9.

CALE WAMSLEY, 68, southwest railway engineer, died recently in St. Louis.

CHARLES F. BROWN, 67, North Tonawanda, N.Y. building contractor, died July 3.

WILLIS S. BALLARD, engineer for the New York Central Ry., died recently in Cleveland at the age of 76.

ZACHARY T. SARGENT, 87, retired Pennsylvania R.R. engineer, died July 3 in Columbus, Ohio.

HONORE MERCIER, chairman of the Quebec Streams Commission and former minister of lands and forests, died recently in Chateauguay, Que.

MOSES B. KAVEN, vice-president and consulting engineer for the United Shoe Machinery Co., Beverly, Mass., died July 1 at the age of 73.

CHARLES L. CADLE, 58, former vice-president and general manager of the Rochester Gas & Electric Corp., chief engineer of the New York State Railways, and superintendent of public works, died July 4 in Binghamton, N. Y.

DAVID A. MACLEOD, retired head of D. C. Weeks & Co., New York contractors, died in Nyack, N. Y., July 11 at the age of 80. Mr. MacLeod supervised the construction of some of New York's early skyscrapers and later several of the large hospitals.

CHARLES H. EGLEE, at one time general manager of the Ambursen Hydraulic Construction Co., now the Ambursen Construction Co. of Boston, died at Cohasset, Mass., July 4, at the age of 79. Mr. Eglee had been active for 25 years in waterworks and other civil engineering activities in New England.

O. J. WESTCOTT, consulting structural engineer, Chicago, 68, was killed July 11 by lightning while fishing near McHenry, Ill. A native of Chicago, he began engineering work in that city in 1886. In early days he was associated with A. Gottlieb, the Lassig Bridge & Iron Works, and the Illinois Steel Co. In 1901 he opened his own office specializing in the design of steel buildings and bridges.

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

INDIANA STATE HIGHWAYS

OWNER: State Highway Department; M. R. Keefe, Engineer.

PROJECT: Construction of 0.382 miles concrete pavement in Gibson Co.; 3.811 miles concrete pavement in Tippecanoe Co.; and 3.647 miles grading and concrete structures in Martin Co.

BIDS: Opened June 8, 1937, with all materials required for the construction furnished by the contractors, and minimum hourly wage rates stipulated of 60c. for skilled and 45c. for common labor.

LOW BIDDERS:

I. Gibson County—0.382 miles concrete paving.

1. Pioneer Contracting Co., Evansville, Ind..... $21,703
2. Foulkes Contracting Co., Terre Haute, Ind... 22,970
3. Flaud M. Lloyd, Sullivan, Ind..... 24,896

II. Tippecanoe County—3.811 miles concrete paving.

1. Roger Daoust, Defiance, Ohio..... 146,805
2. Wm. D. Vogel, Indianapolis, Ind..... 153,571
3. Pioneer Contracting Co., Evansville, Ind..... 154,224

III. Martin County—3.647 miles grading and structures.

1. Highland Co., Inc., Louisville, Ind..... 54,874
2. U. R. Price & Co., Bloomington, Ind..... 57,130
3. General Dredging Co., Ft. Wayne, Ind..... 59,756

I—GIBSON COUNTY PROJECT

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Excavation	3,157 c. y.	$0.45	$0.50	$0.50
2. Excav. special borrow	836 c. y.	.50	.50	.60
3. Conc., strs. special Cl. D	100.5 c. y.	35.00	30.00	25.00
4. Conc., strs. Cl. D	1.8 c. y.	35.00	30.00	25.00
5. Reinf. steel, strs.	6,855 lb.	.06	.05	.05
6. Struct. removal, culvt. extens.	2 each	100.00	125.00	50.00
7. Finish shoulders, ditches	2,129 l. f.	.15	.15	.20
8. Guard rail removal	196 l. f.	.10	.20	.50
9. Maintain traffic	L.S.	750.00	1,800.00	3,400.00
10. Remove pavt.	4,080 s. y.	.25	.40	.40
11. CM pipe, 12 in	32 l. f.	1.40	1.00	1.50
12. CM pipe, 15 in	106 l. f.	1.60	1.50	2.00
13. Sewer pipe misc., 6 in., b. c.	50 l. f.	.50	1.20	.70
14. C.M. pipe, perf., 6 in., b. c.	50 l. f.	.75	1.20	.70
15. Perf. misc. drains, 6 in.	50 l. f.	.45	1.00	.60
16. Agg., subsurf. drains	10 l. f.	3.50	2.50	3.00
17. Reinf. conc. pavt.	3,828 s. y.	2.50	2.50	2.60
18. Reinf. conc. pavt. spec.	1,091 s. y.	2.75	2.65	2.80
19. Expansion joint	1,040 l. f.	.60	.60	.80
20. Perf. C.M. pipe, 6 in	50 l. f.	.70	1.00	.60

II—TIPPECANOE COUNTY PROJECT

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Excavation	18,730 c. y.	$.32	$.40	$.40
2. Excav. spec. borrow	3,305 c. y.	.35	.50	.50
3. Spec. fill material	50 c. y.	1.50	2.00	.75
4. Finish shoulders, ditches	22,184 l. f.	.12	.15	.15
5. Conc. strs., Cl. D	6.0 c. y.	25.00	30.00	20.00
6. Conc. strs., spec. Cl. D	134.9 c. y.	23.00	25.00	25.00
7. Reinforce steel, structs.	16,314 lb.	.04	.05	.06
8. Conc. catch basin	1 each	100.00	120.00	125.00
9. Spec. conc. catch basin	6 each	40.00	90.00	125.00
10. Spl. conc. inlet, Type A	12 each	70.00	65.00	60.00
11. Spl. conc. inlet, Type B	20 each	100.00	95.00	100.00
12. V. C. pipe inlets, 12 in	2 each	25.00	25.00	30.00
13. Remove culvert extensions	2 each	75.00	50.00	50.00
14. Sodding, fertilized	3,379 s. y.	.25	.18	.26
15. Dress, sod, fertilized	3,577 s. y.	.30	.22	.31
16. Seeding, fertilized	3.4 acre	40.00	75.00	20.00
17. Side ditch, paved	50 l. f.	1.00	1.10	1.20
18. Lip curb, Type A	3,436 l. f.	1.30	1.05	1.25
19. Lip curb, Type B	3,811 l. f.	1.20	1.05	1.25
20. Lip curb, Type C	1,220 l. f.	1.00	1.20	1.15
21. Curb removal	36 l. f.	.40	.20	1.00
22. Pavt. removal	3,935 s. y.	.40	.35	.27
23. Flex. steel guard rail	10,754 l. f.	.85	.85	.90
24. Flex. steel g.r. reset	1,172 l. f.	.50	.40	.60
25. Top soil	600 c. y.	1.00	.60	1.20
26. Gravel surf., Cl. C	237 c. y.	2.10	3.00	1.75
27. Sewer pipe misc., b.c. 6 in.	360 l. f.	.50	.50	.35
28. Perf. c.m. pipe, b.c. 6 in.	194 l. f.	.90	1.00	.75
29. Perf. c.m. sewer pipe, 6 in.	640 l. f.	.50	.50	.27
30. Perf. c.m. pipe, 6 in.	150 l. f.	.90	.90	.70
31. Pipe, c.m., 12 in.	690 l. f.	1.10	1.35	1.40
32. Pipe, c.m., 15 in.	36 l. f.	1.40	1.60	1.85
33. Pipe, c.m., 24 in.	240 l. f.	2.50	2.60	2.70
34. Pipe, r.c., v.c., c.i., 12 in.	420 l. f.	1.15	1.25	1.40
35. Pipe, r.c., v.c., c.i., 15 in.	174 l. f.	1.40	1.50	1.85
36. Pipe, r.c., v.c., c.i., 18 in.	708 l. f.	2.00	1.90	2.50
37. Pipe, r.c., v.c., c.i., 24 in.	14 l. f.	2.50	3.00	3.00
38. Pipe, r.c., v.c., 12 in.	120 l. f.	1.15	1.25	1.40
39. Pipe, v.c., sewer, 18 in.	60 l. f.	1.50	1.65	2.50
40. Pipe, r.c., 15 in.	24 l. f.	1.40	1.50	1.85
41. Relay c.m. pipe, 12 in.	16 l. f.	.70	1.25	2.00
42. Agg., sub-surf. drains	265 c.y.	2.10	2.50	3.50
43. Reinf. conc. pavt.	54,200 s. y.	1.71	1.80	1.75
44. Reinf. steel, pavt.	5,213 lb.	.04	.05	.06
45. Expansion joints	10,362 l. f.	.48	.50	.50
46. Expansion joints, type D	1,496 l. f.	.75	.70	.60
47. Expans. joints, cork, 1 in.	590 l. f.	.50	.50	.70
48. Expans. joints, bit., 2 in.	114 l. f.	.25	.20	.30
49. Anchor bolts	120 each	1.00	1.00	.75

III—MARTIN COUNTY PROJECT

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Excavation	75,447 c. y.	$0.28	$0.29	$0.32
2. Excav. spec. borrow	8,036 c. y.	.28	.29	.33
3. Excav. solid rock	13,000 c. y.	.75	1.00	.90
4. Overhaul, one balance	1,059 c. y.	.05	.10	.05
5. Paved side ditch	2,425 l. f.	.90	.80	.85
6. Monument, type C	1 each	10.00	7.00	10.00
7. Pipe, 12 in.	32 l. f.	1.20	1.10	1.05
8. Pipe, 15 in.	170 l. f.	1.50	1.35	1.30
9. Pipe, 18 in.	208 l. f.	1.75	1.50	1.65
10. Pipe, 24 in.	210 l. f.	2.50	2.35	2.10
11. C.M. pipe, 84 in.	52 l. f.	16.50	13.50	15.50
12. Pipe, r.c., c.i., c.m., 30 in.	48 l. f.	3.25	2.80	3.00
13. Pipe, r.c., c.i., c.m., 36 in.	216 l. f.	4.25	4.30	4.30
14. Pipe, r.c., c.i., c.m., 42 in.	118 l. f.	5.00	5.20	5.25
15. Pipe, r.c., c.i., c.m., 48 in.	210 l. f.	7.00	7.25	7.50
16. Sewer pipe, misc. b.c., 6 in.	250 l. f.	.70	.65	.75
17. Perf. c.m. pipe, b.c., 6 in.	110 l. f.	1.05	.90	.75
18. Sewer pipe, misc., 6 in.	250 l. f.	.70	.60	.50
19. Perf. c.m. pipe, 6 in.	110 l. f.	1.00	.85	.70
20. Agg. sub-surf. drains	36 c. y.	2.50	2.80	2.50
21. Rip rap	211 s. y.	2.50	1.60	2.00
22. Conc. struct. special Cl. D	6.6 c. y.	23.00	25.00	22.00
23. Conc. struct. Cl. D	510.1 c. y.	22.00	20.00	22.00
24. Reinf. struct steel	35,235 lb.	.05	.045	.0475

CONCRETE HIGHWAY BRIDGE, CALIF.

OWNER: State Highway Commission, Sacramento, Calif.; C. H. Purcell, engineer.

PROJECT: Construction of a reinforced concrete bridge across Myrtle Creek, 10 mi. north of Crescent City, Del Norte Co., consisting of eighteen 15-ft. spans on open spandrel arch and concrete bents and abutments, and 0.24 mi. grading and asphalt treatment of approaches.

BIDS: One bid only, of $50,645, was opened on June 9, 1937; minimum hourly wage rates stipulated of $1.00 for skilled and 60c for common labor; all materials and labor required for the construction to be furnished by the contractor.

LOW BIDDERS:

1. F. O. Bohnett, Campbell, Calif..... $50,645

Item	Quan.	Unit Prices
1. Clear, grub	1.7 acre	$100.00
2. Water	85 M. g.	1.00
3. Roadway excav. uncl.	5,300 c. y.	1.00
4. Stripping	150 c. y.	2.50
5. Excav. struct.	500 c. y.	5.00
6. Excav. ditch, channel	60 c. y.	2.00
7. Overhaul	5,100 st. y.	.02
8. Finish roadway	15 sta.	15.00
9. Asphalt, SC-1A, prime	8 ton	30.00
10. Asphalt, 90–95, seal	4.5 ton	40.00
11. Screenings, seal coat	51 ton	12.00
12. Reinforcing steel	152,000 lb.	.07
13. Concrete, cl. A, struct.	600 c. y.	36.00
14. Conc. cl. A, arch, strut	131 c. y.	36.00
15. Conc. cl. A, railing	19.5 c. y.	65.00
16. Reset Conc. headwall	1 ea.	25.00
17. C. M. pipe, 30 in. relaid	52 l. f.	1.50
18. C. M. pipe, 8 in.	30 l. f.	1.00
19. Spillway assemblies	2 ea.	25.00
20. Bridge deck drains	7 ea.	35.00
21. Guide posts	28 ea.	2.00
22. Culvert markers	2 ea.	2.00
23. Clearance markers	2 ea.	12.00
24. Demolish bridge	1 ea.	600.00
25. Misc. items	L. S.	1,400.00

(Additional Contract Unit Prices on second following page)